NOVEMBER, 1961

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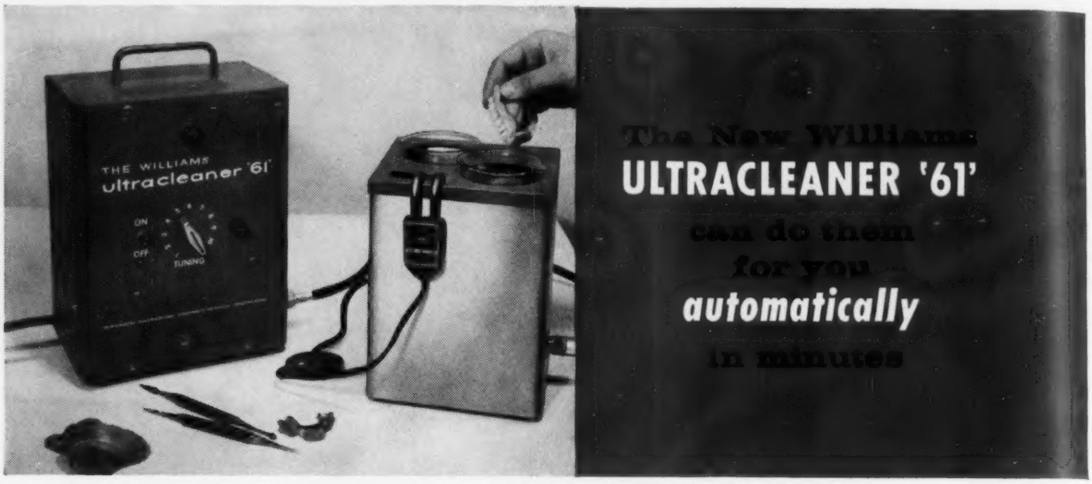

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Volume 47, *Number* 11, NOVEMBER, 1961

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IN MEMORIAM

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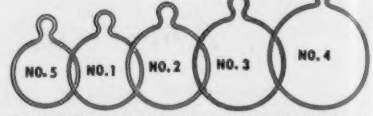

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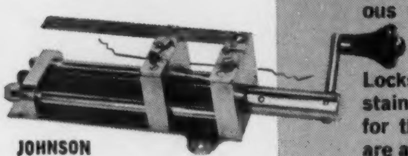

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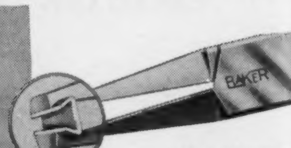

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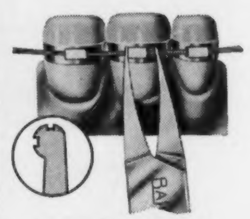

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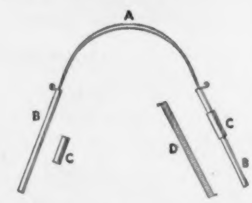

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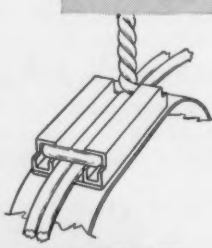

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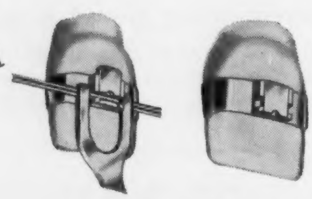

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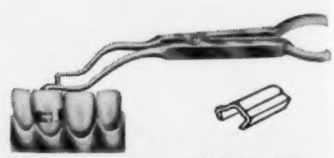

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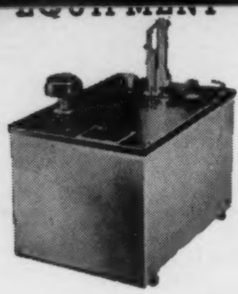

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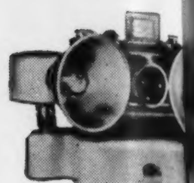

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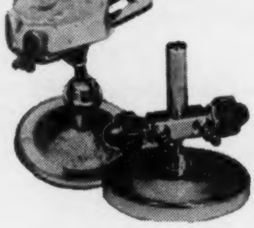

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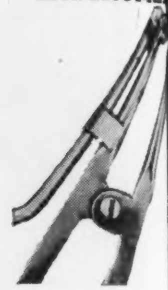

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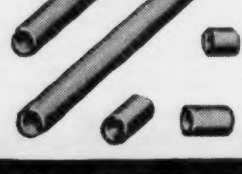

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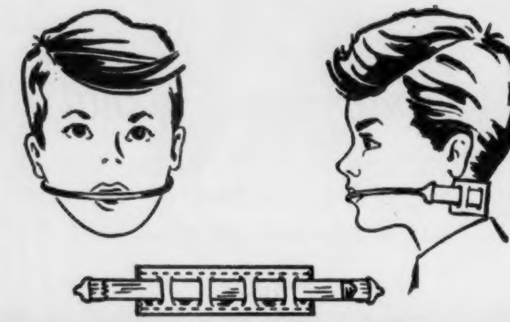

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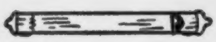

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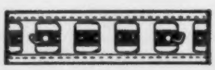

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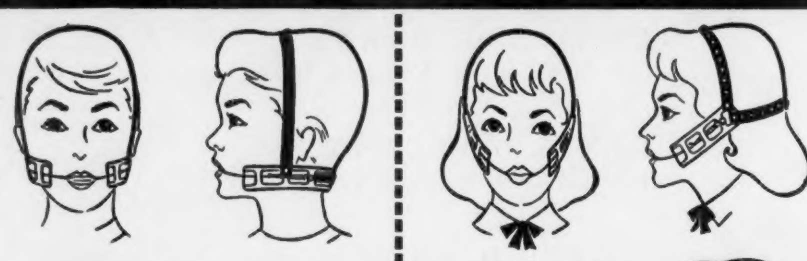

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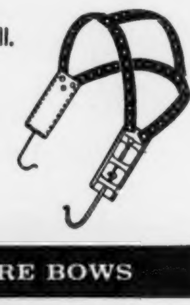

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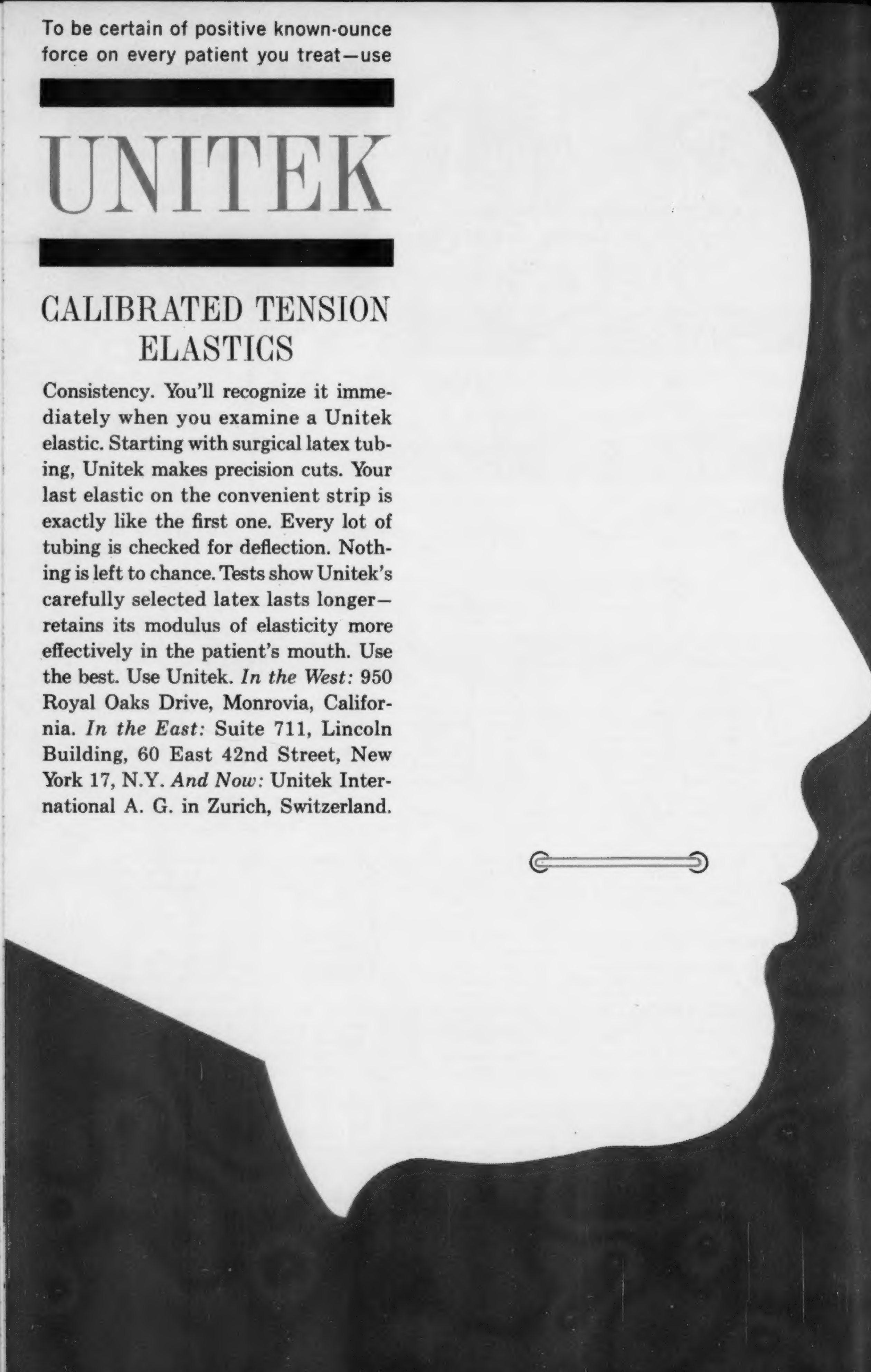
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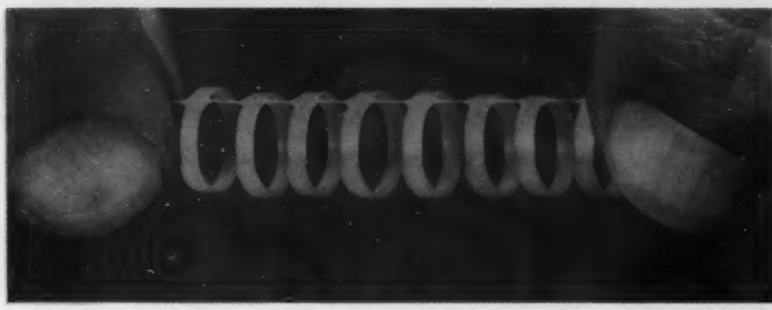

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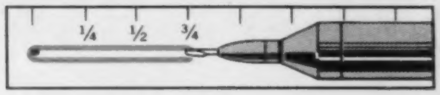

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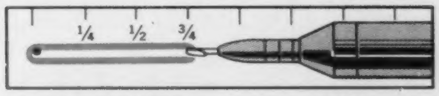

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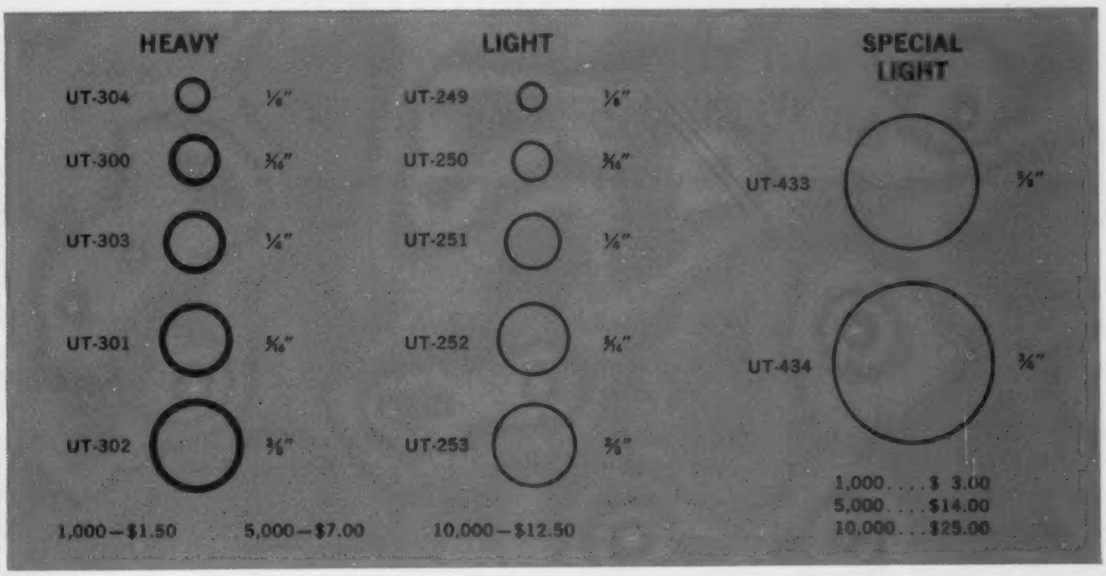

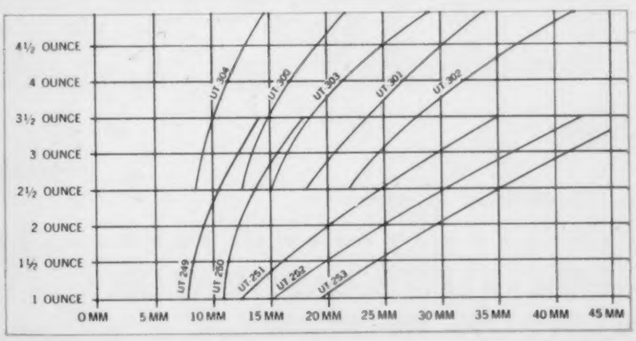

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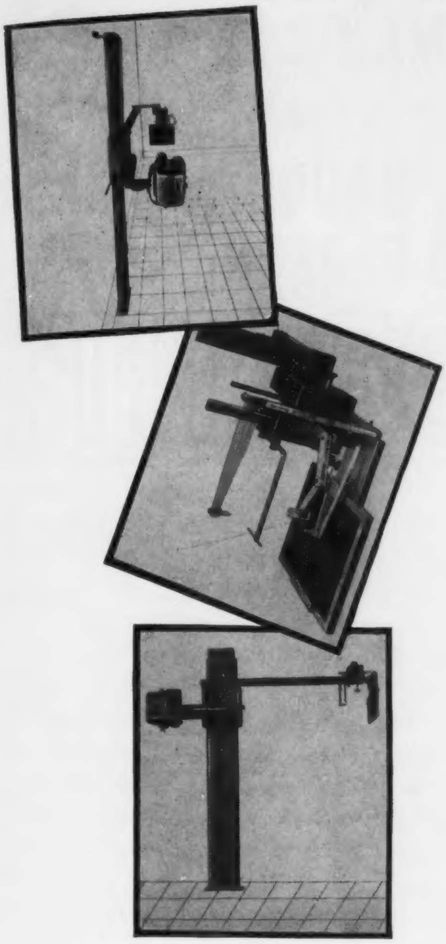

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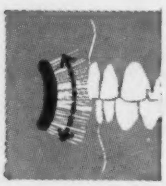

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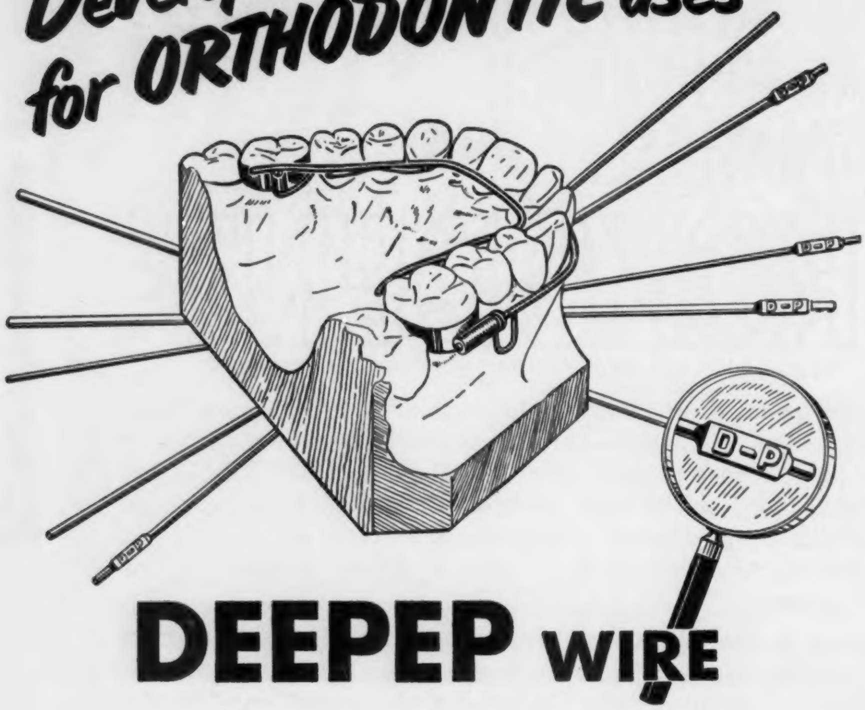

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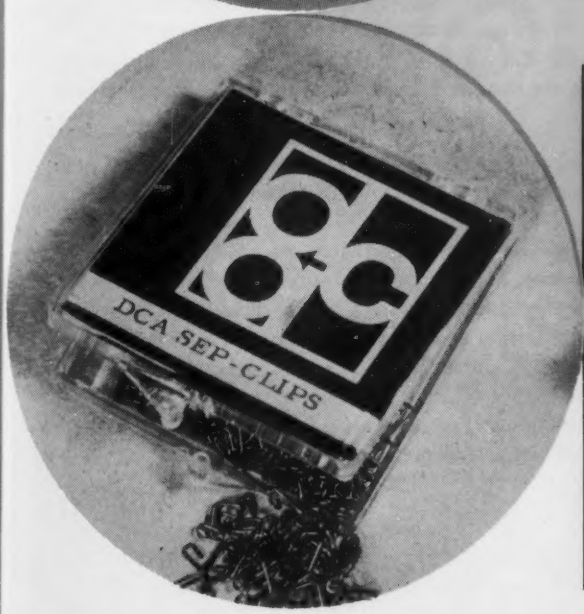

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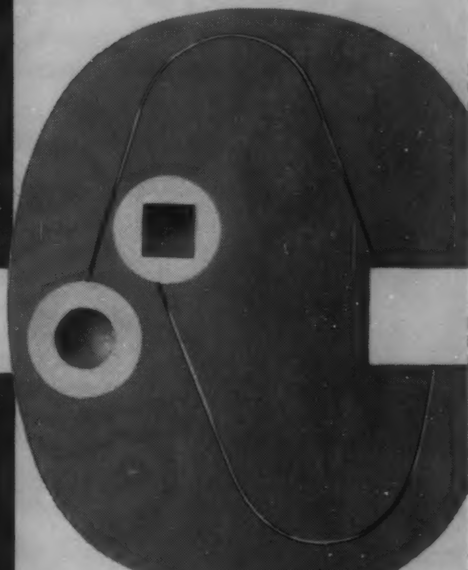

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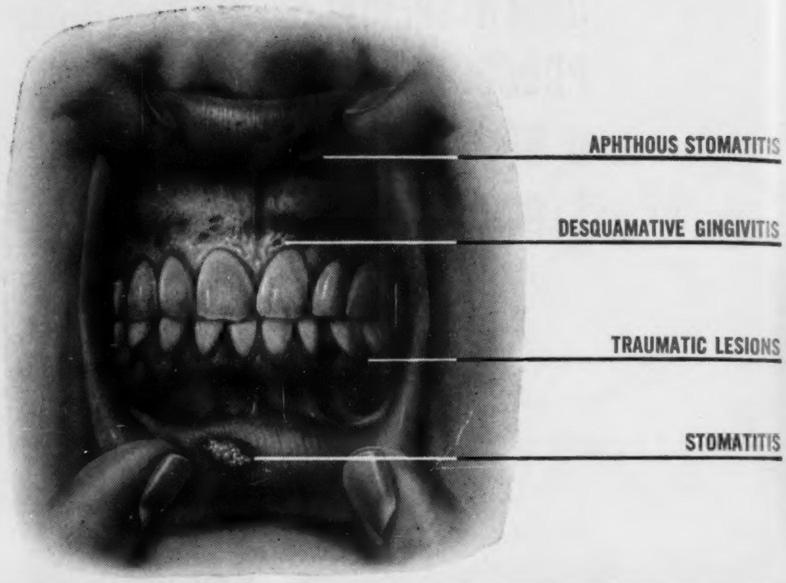

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References: 1. Zegarelli, E. V., and others: Oral Surg. *13*:170 (Feb.) 1960. 2. Zegarelli, E. V.; Kutscher, A. H., and Silvers, H. F.: J. Periodontol: *30*:63 (Jan.) 1959. 3. Katz, E.; Zegarelli, E. V., and Kutscher, A. H.: Ann. Dent. *19*:40 (June) 1960.

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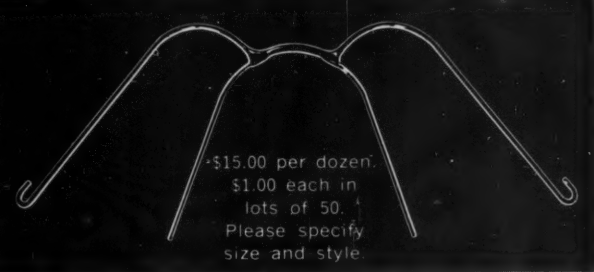

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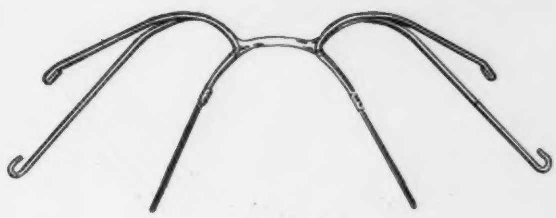

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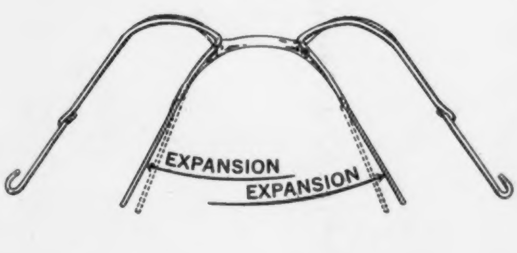

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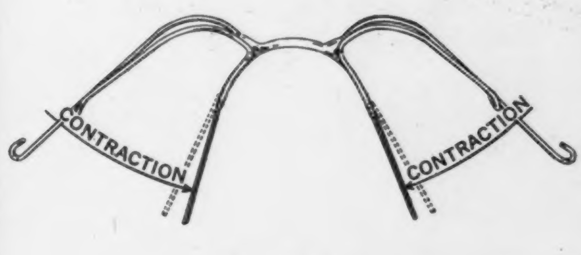

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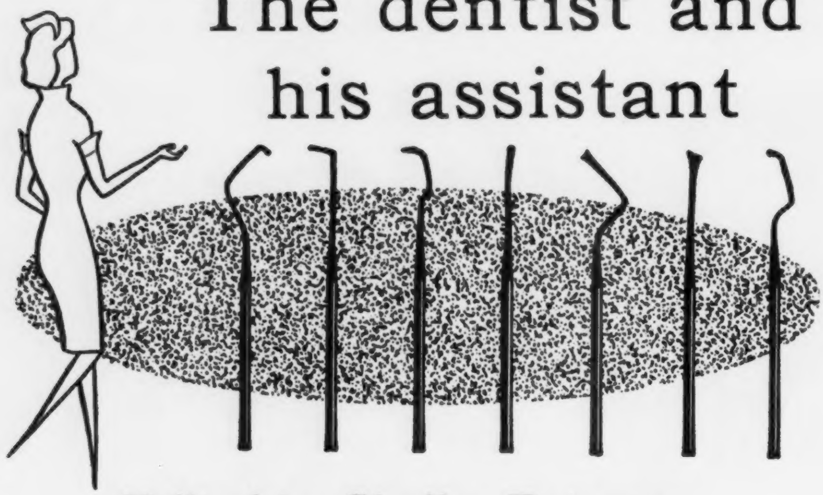

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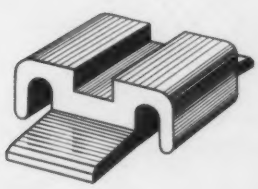

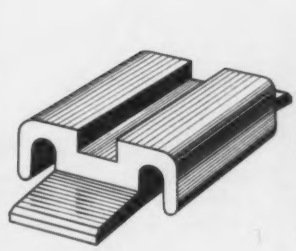

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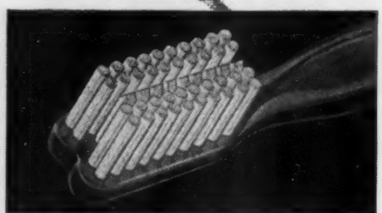

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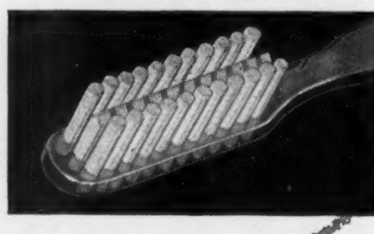

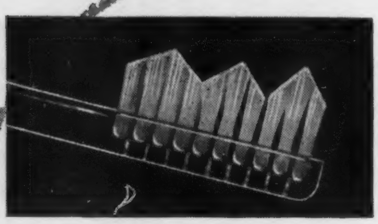

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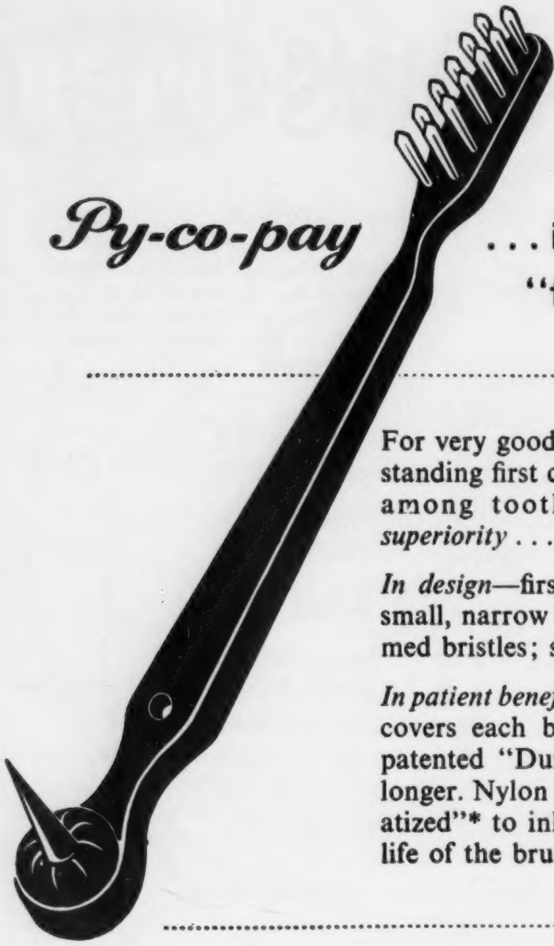

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American Journal of ORTHODONTICS

Volume 47, *Number* 11, NOVEMBER, 1961

ORIGINAL ARTICLES

President's address, Northeastern Society of Orthodontists

HENRY C. BEEBE, D.D.S.

Boston, Mass.

It is the duty of the president of this Society to deliver an address at the annual meeting each year. I am going to deviate a bit and call this a presidential *report* rather than *address*, for I think that aspect is more important. This report is not all original. It is based on communications that I have received and observations that I have made, both before and after I became an officer. I hope to convey some significant thoughts *of* the membership *to* the membership! This material is referred to a special committee, appointed by the vice-president, which examines and determines the usefulness of any suggestions or recommendations contained herein.

Just one year ago President Prezzano stated: "The Northeastern Society of Orthodontists is a very rapidly growing body whose area encompasses some of the greatest populated centers in our nation. Since we are the largest constituent Society and comprise about one-fourth of the membership of the entire American Association of Orthodontists, it follows that our problems are similar to, mutual, and intermingled with those of the parent body." How true! This does not mean that our individual problems are any greater than those of individual members of other constituents of the American Association of Orthodontists, but it does mean that, collectively, we have more of them and consequently we have a greater responsibility in attempting to solve them. This past year new problems have arisen which deeply concern our relationships with the American Association of Orthodontists and the American Dental Association. Oustanding among these are the problems concerning specialism posed by Resolution 2 of the Council on Education of the American Dental Association, the problem posed by labor union demands, and the problem of better communication with members of the Northeastern Society of Orthodontists.

On Tuesday, Oct. 18, 1960, the following resolution was submitted to the Reference Committee on Specialism at the American Dental Association in

Presented before the Northeastern Society of Orthodontists, New York, New York, March 6, 1961.

Los Angeles: "Resolved, that after January 1, 1965, all members who announce themselves to the public as specialists or as limiting their practices in one of the areas approved by the American Dental Association be *required to hold a certificate from a National Certifying Board approved by the American Dental Association,* or a state license permitting announcement in one of the areas approved by the American Dental Association." While this matter has been reported on fairly extensively in the JOURNAL, I would like to comment on one aspect of this problem, namely, the importance of active participation in the affairs of our parent organization, the American Dental Association, by members of all specialty groups. This becomes particularly important when matters relating to specialism are to be considered. At the meeting of the American Dental Association in Los Angeles, two meetings of orthodontists and a luncheon attended by representatives of several specialty groups were held to discuss Resolution 2 of the Council on Dental Education. At the hearing of the Reference Committee on Specialism, with approximately 200 in attendance, the opinions expressed were overwhelmingly in favor of either defeat of the resolution or postponement for at least another year. The Northeastern Society of Orthodontists was well represented at this hearing, and our Wilbur Johnston, who is a delegate to the American Dental Association from the state of Connecticut, was commended by President Humphrey of the American Association of Orthodontists for his work as chairman of this committee at the Executive Council meeting in Boston last November 13. At the American Dental Association House of Delegates meeting on Thursday, the Reference Committee brought in a motion that action on the resolution be postponed for a year; this motion was adopted. Currently, the matter as it relates to orthodontists is being considered by a special committee of the American Association of Orthodontists. Members of the Northeastern Society of Orthodontists should not divorce themselves from the parent American Dental Association but, rather, should take a more active part in their national, state and/or provincial, and local dental societies. Then, when questions arise which concern all areas of dentistry, we will be well represented and intelligently informed.

Another problem facing our profession is that posed by the efforts of labor unions to establish plans for dental care (including orthodontics) of their members and dependents which are not in conformity with the criteria for such plans as established by the profession. Here again, we need to enlist the aid of all dentists and to stand with unity to present programs that will be acceptable to the public and protect its welfare.

An orthodontist writes: "Panels of dentists have been formed by unions and growth has been steady to the point where more dentists have applied than are accepted. These panels have incorporated features that are not in keeping with the local dental societies' approval. At hearings where labor and dentistry are represented, dentistry must be prepared. The American public will be looking to its various health organizations to provide adequate service within the individual specialties. If such services are not forthcoming, then the government will step in and attempt to fill the gap. It is quite apparent that there must be an increase in the orthodontic service rendered to the

underprivileged. Perhaps we should stimulate the formation of orthodontic clinics in hospitals and in schools, where dental services are now available. Organized orthodontics should investigate and approve or disapprove all clinics and their personnel. In this way, there is some measure of control exercised by the Society. We are a statistically minded people. If a given clinical facility can issue statistical information in regard to orthodontic treatment, this would have an immense public relations value. Time is passing rather rapidly, and if we do not come up with some answers we may have to accept some solutions we do not like."

The Northeastern Society of Orthodontists now has a Committee on Dental Care Programs for Groups. Its chairman, Walter Bedell, answered this man as follows: "I see much merit in your suggestions. It is a highly complex problem and one in which I believe we should take some guidance from the state dental societies and the American Dental Association."

This points up the necessity of our working with other professional groups whose objectives are also to assist in solving these problems while maintaining traditional high professional standards. The continuing study of dental care for groups by the American Dental Association has developed many basic principles in relation to such programs. Specifically, in relation to orthodontic care, we have the principles adopted by the American Association of Orthodontists in 1954 as a guide to practitioners of orthodontics who contemplate participation in public health orthodontic programs and prepayment service plans which include orthodontic care. These principles were developed by our own Jack Salzmann. Another valuable contribution, when available, will be the results of the proposed study to be undertaken by the American Association of Orthodontists to determine the prevalence of physically handicapping defects requiring orthodontic interference and the availability of personnel and facilities to provide the necessary orthodontic care.

While many of these problems require committee or even Society effort, we welcome and are trying to stimulate the interest of individual members. Not all of our members can become officers or serve on committees, but they should participate nonetheless in the welfare of the Society, when they see fit, by contacting those who hold office.

Another member writes constructively: "Executive Committee meetings are probably the only place where one can get a satisfactory picture of the activities of the Northeastern Society of Orthodontists. The mass of the membership, for obvious reasons, cannot attend these enlightening sessions. The average member sitting in the business meeting simply is not adequately informed to discuss or even understand the reasons for many of the items that are considered. This situation has prompted me to make the following suggestions. The entire membership should receive a small newsletter at definite intervals providing reports of our activities. A semi-annual four-page, inexpensively printed publication should be of interest and adequate. I think the Society has a responsibility to attempt to keep the membership informed. There should be an established means of intra-Society communication."

Another letter of importance is from the chairman of our Necrology Committee. He states that it is the *duty* of every member, upon hearing of the death of a member in his area, to notify the chairman of the Necrology Committee, who then may take the necessary actions. A second letter followed within a few days, stating that since the name and address of the Necrology Committee chairman is not always accessible to every member and since the chairmanship may change each year, it would be more feasible to notify the secretary-treasurer of deaths within the Society. Surely, this is the least any member can do out of respect to the deceased and his family. Furthermore, when the Necrology Committee is unaware of the death, much embarrassment may be caused. The Relief Committee and the Emergency Advisory Committee are faced with the same problem. They must depend upon the individual member assuming the responsibility of notification.

We should strive for better continuity in our program planning from one year to the next. Why not benefit from the mistakes of the past and develop more fully those things that we find are improvements? This situation has been getting better from year to year. I know from experience! When I first started doing Society work, there were only letters, odds and ends, a few plans, and thoughts of the predecessors, but no organized outlines, as such, to follow. You were more or less on your own. In my opinion, one of the most constructive suggestions made by a president was that made by Philip Adams in his presidential address at the American Association of Orthodontists meeting in Boston when he recommended the formation of a program manual for the American Association of Orthodontists. Edward Martinek, was chairman of that first Program Manual Committee, upon which I served, and he must have spent many, many hours in its development. It may not have been a masterpiece originally—although I thought it was—but it is revised from year to year until it has become the bible of the newly formed committees. No one can know how helpful this manual has been unless he has had the opportunity to refer to it for guidance.

A program manual for the Northeastern Society of Orthodontists will make for a smoother running, better organization! The Consultant Group to the Executive Committee consists of the three immediate past chairmen to the Executive Committee. The senior member serves as chairman and each year is retired as the next man moves upward. This committee should have a specific assignment and, I think, should take the responsibility of developing this program manual and keeping it up to date. It should be patterned somewhat after that of the American Association of Orthodontists. Why not make better use of this committee's experience, knowledge, and talents?

In this age of rocketry, satellites, and electronics, many of our professions are suffering from lack of likely candidates. Law, medicine, and dentistry have all felt this pinch. Our schools are not filled to capacity; nor are we getting the cream of the crop, as we were a few years ago. This is in spite of the fact that we have an ever-increasing population and a diminishing ratio of dentists per capita. Public relations are helpful, but the men who are really in the

know say that it is up to the individual dentist to recruit the better students. I believe this to be true. Surely, we have much personal contact with the high school students when they are about to make their decisions as to their future. We should try to impress these young people and sell them on our profession if we are to keep our standards high. I think we should take advantage of opportunities to speak before Service Clubs, Parent-Teacher Associations, and the like. Fundamentally, the success of our profession depends upon our personnel. To prove that I am not just making talk, I recently invited a member of the dental profession to speak before my Rotary Club. Twelve Junior Rotarians were present, all of whom were members of their senior class. Each was asked, early in the program, about his choice of professions, and none mentioned dentistry. After the talk some of these Junior Rotarians voluntarily came up to ask questions, and in the weeks that followed many more questions were asked of me. Dentistry and orthodontics need more of this. Let each of us become an ambassador of good will for dentistry! Take pride in your profession!

During this administration the new associate membership in the American Association of Orthodontists has come into being. It has meant an increase in dues for these persons, but a saving if they attend the national meeting. It has given them the added prestige of being members of the American Association of Orthodontists. To my knowledge, there has been little complaint from the applicants, and this change has gone through rather smoothly.

To summarize, the following are my recommendations:

1. Members of the Northeastern Society of Orthodontists should take an increasingly active interest in the affairs of their national, state and/or provincial, and local dental societies.
2. The Northeastern Society of Orthodontists, through its Committee on Dental Care Programs for Groups, should work closely with local, state and/or provincial, and national dental associations or societies toward the development of programs in conformity with the criteria established by the profession for such programs.
3. A newsletter should be created as an interim method of informing the membership of actions of the Society and other pertinent data in the intervals between *President's Letters.*
4. Individual members should assume the responsibility of notifying the secretary-treasurer of the Society of deaths of members and of situations in which help is needed from the Relief Committee and/or the Emergency Advisory Committee.
5. A program manual should be developed for the Northeastern Society of Orthodontists, and I suggest that it be developed and revised by the Consultant Group to the Executive Committee.
6. Members of the Northeastern Society of Orthodontists should assist in the recruitment program for dentistry.

I want to thank you for the honor of being president. It is not an easy task, but it is a rewarding one. I believe that I have profited by the experience,

and I trust that you have not suffered. The goal of this administration has been to serve the Society, and if we have stimulated your interest enough to draw two good attendances and then have given you something worth while we have accomplished our mission.

Finally, if I may paraphrase the statement of one of our national leaders, let us ask ourselves the question: "What can I do for my Society, not what can my Society do for me?"

May I again express my gratitude to my predecessors, my advisors, Mrs. Grimm, and the officers, and the committeemen for their excellent cooperation. Many thanks to you all!

60 Charlesgate West.

Orthodontics as a public health service

LEONA BAUMGARTNER, M.D.*
New York, N. Y.

FOREWORD

Orthodontics as a public health service was discussed by Leona Baumgartner, M.D., Commissioner of the Department of Health Service, at the March, 1961, meeting of the Northeastern Society of Orthodontists. The address, which was delivered at a luncheon, attracted considerable attention and it is thought that it will be of great interest to the readers of the American Journal of Orthodontics.

In 1944 the New York State Legislature passed a rider bill decreeing that treatment of the facial deformities (when regarded as a crippling condition) should be provided for in the Rehabilitation of Crippled Children Program in the New York State Public Health Service. The New York State Commissioner of Health sent Dr. David Ast, Director of the Bureau of Dentistry, before the meeting of the N. E. S. O. to request appointment of an Advisory Committee. The committee appointed by President William Keller, consisting of Henry W. Barber, Joseph D. Eby, Jack A. Salzmann, Franklin A. Squires, and Leuman M. Waugh (Chairman), set up the general plans and established eligibility requirements of patients under Social Service Department fees at taxpayer levels; the operational plans have been successful and little, if any, change has been made. At that time, Dr. Baumgartner, as a specialist in pediatrics, was Director of the Bureau of Rehabilitation which was combined with the Bureau of Dentistry in the project.

Editor.

I KNOW that you want to get around to your scientific meetings and that you have to have somebody talk to you at lunch. Therefore, I do not intend to take up too much of your time in fulfilling my assignment. However, I really want to acknowledge one of the very nicest things that has ever happened to any physician (and, certainly, to any lady), and that is what has happened to me as a pediatrician and as a public health officer as a result of my contact with the dentists of the City of New York. They have been so wonderful through the years in teaching me and opening my eyes to things that needed to be done when we went wrong. Perhaps it was because I was trained as a pediatrician that I was initially interested in dental health; certainly, as a public health person I

Presented at a luncheon session during the annual meeting of the Northeastern Society of Orthodontists, New York, New York, March 6, 1961.

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became interested in the single largest problem that in many ways affects more people than anything else in the public health field—the dental problem.

I have had occasion now and then to read the history of health services in New York City and elsewhere, and I have been impressed by two things. One is the growth and development of the service that the dental profession has given. I put the dentists far out in front of physicians in terms of some of their social points of view. Perhaps it is because dentistry developed later as a profession than medicine. The other thing that has impressed me is the slow but solid development of public health services in the numerous branches of dentistry in this city.

I know that many of you come from outside New York City, but if you do not mind I just cannot resist (because this is the only chance that I have had) the temptation to review with a group of dentists—particularly a group of orthodontists—some of the things that have happened here. I do not know if you all realize that our first publicly supported program began some fifty years ago in New York City. As was probably inevitable, when it began, its first platform was one of treatment. As a matter of fact, the first treatment was just to extract teeth that hurt and then send the kids on their way. In that first year (1913) we had some ten dental units with which some 2,000 children were treated. Today, in 1961, we have some 250 units and we treat some 52,000 children with a very comprehensive service. The current budget is about $1,700,000.00, and this is only for dental supplies and dental personnel; at present there are 213 orthodontists on the Greater New York City panel and approximately 3,000 cases under treatment.

The next part of the program to be initiated was that of dental rehabilitation, and this is the activity about which I learned so much from you orthodontists. As an extension of the general rehabilitation programs that were then becoming more popular in medicine, it seemed reasonable that handicapping conditions of dental origin should be included in the programs that were treating children who had orthopedic and other handicaps, so as a part of our then so-called Crippled Children's Services we established an orthodontic program. It was quite evident, as soon as we began to look at the physical handicaps of growing children in the dental field, that you could not do much for them unless you did a great deal about orthodontics. It was at that time that the Northeastern Society of Orthodontists was approached simultaneously by the New York State Health Department and the New York City Health Department to assist in establishing a program on a sound basis. That was the kind of thing that we were trying to do in those many night meetings with the original Advisory Committee.

We needed very specific help. We needed assistance in defining the types of defect which could be considered handicapping malocclusions. The one thing we did not want was to give a politician, or even a practicing dentist, the chance to charge us with being arbitrary in our decisions about accepting children for treatment. There were lots of dangers which we tried to anticipate in that first program.

We also needed standards. In my opinion, if you are wise, you never start a

program using tax funds without setting some standards and some specific requirements—not only for the kind of work to be done but also for the kind of people who are going to do it. We therefore got standards set for individual orthodontists and for the orthodontic clinics that would come along to help in the program.

One of the first decisions which we made was that this was to be a joint program. It was not planned to be a program in which the city would be required to set up a lot of new clinics. There was not the personnel to do this. It did not make any sense. I do consider this program that we have developed here in New York as one of the outstanding examples of cooperation between government and private enterprise, so to speak. This is a truly cooperative kind of program in which tax dollars are used for financing but the work is done essentially in private offices and clinics.

We needed help in establishing a reasonable fee scale, and we needed all kinds of advice on special problem cases.

What first impressed me, and the thing that I remember, was the wonderful cooperation and dedication of that group who first met about this program. That original Advisory Committee appointed in 1944 by the then president of your Society, Dr. William C. Keller, included Drs. Henry U. Barber, Joseph D. Eby, Jack A. Salzmann, Franklin A. Squires, and Leuman M. Waugh (chairman). These people sat night after night and have contributed through the years in establishing a thoroughly sound program. Incidentally, they did this without getting paid. This is not one of those $50.00-a-night jobs or anything like that at all. I think they and we—and certainly, the parents and the youngsters involved (and perhaps that is what counts more than anything else)—have found this program to be a very gratifying one.

The program itself has been successful from every viewpoint. Our relationship with you orthodontists has been a very happy one; the public interest in this service has been very keen. I can remember that when it first began we used to save the models. We had to get bigger bookcases to keep them in. When the reporters came around to the Health Department and wanted to see something, we just took them down and showed them the Bureau of Dentistry's bookcases with some of the "before and after" models. They were fascinated. They used to look at them and take pictures and, in all, there was great public interest in that service. Of course, chiefly I love to think of the people who are now 25 and 30 years old, married, and having children of their own. I sometimes wonder if they ever would have gotten married if their teeth had not been fixed up when they were younger. Maybe because I was a lady, I was particularly interested in getting an orthodontic program started, because I do not think that a girl with a badly shaped mouth has a very good chance with you guys—no matter what age she is. Certainly, you produced more attractive smiles and faces, and you have produced a good many better-adjusted, well-satisfied, and healthier people.

The growth of the program in dollars and cents alone means something. If I remember correctly, we decided that we would start very modestly with a limited number of children, but now we are caring for about 3,000 children a year, and some $500,000.00 is spent in this program annually.

All of this is fine, but what is really better—and both you and I know it—is prevention. Here, again, I take off my hat to the dentists of this country who have promoted fluoridation in the way they have. I hope we will soon have fluoridation in New York City. Certainly, with all of our effort at dental treatment and rehabilitation, we realize that we will never get the job done without it. Let us just take the figures in New York City of unmet dental needs among children each year. One-third of our children (over 350,000) are victims of complete dental neglect. This means that no dentist sees their mouths at all. Obviously, prevention is the real answer. It seems such a wise investment of money, too.

Now I would like to talk a little bit to you not about New York City and not about orthodontics entirely, but about the four major problems, as I see them, that face the health professions today. I do this very deliberately, because it seems to me that as you look forward to what is going to happen in your own field you will inevitably bump into these problems and opportunities.

I think that the first thing on the horizon is that the public has a great interest in how they are going to pay their bills. I do think it is quite evident that a great deal of experimentation and a great deal of creativity will be needed to find out how we are to help people pay for the services that they want. I think the kinds of experimentation that are going on in the field of prepaid dental insurance, prepaid medical insurance, etc. are interesting. I do not think this is the complete solution, however, for if we had all the money in the world right now we could not solve our problems anyway.

This brings me to the second major problem. Certainly you have in dentistry, as we have in all the other health professions, a most acute shortage of personnel. Training more people is part of the answer, but I wonder if another part of the answer is not following out a little bit more energetically some of the things that you have done in your own offices, for I have been told about and I have been much impressed by the way in which you have learned how to use people who were not trained with a full course in orthodontics. This, I believe, has been called "deskilling the job and upgrading the worker." Those are awfully fancy words, but it would seem to me, as we look at the technical jobs to be done in medicine, in dentistry, and in nursing, for example, that we will find an increasing number of things that the highly skilled person does not need to do all by himself. He needs to supervise it. He needs to train the person who does it. He needs to have responsibility for it, but we may find that we can bring about an increasing transfer of some of our load to people who will be trained to do the particular job they are doing. This is one line that I think we can explore in addition to simply making scholarships available so that more persons can go to school and maybe building new medical schools, dental schools, nursing schools, etc.

The third thing that I think we have to begin to look at—and here I hope that you would be as wise as I think you have been in so many other areas in taking a lesson from the experiences of my profession of medicine, for you, too, are faced with the problems that arise when you specialize in a particular profession—is that you also are going to be faced with the problems of increased

population. And don't think we have not got a population explosion in the United States! Our problem is not only training more people; it is finding a different way of using the trained people that we have.

Look at the amount of time and effort spent by members of the medical profession as they dash from one clinic, to one hospital, to one office—just the travel time in New York City. I do not know how much that would mount up to, but I wish somebody would make a study to find out how much more medical care would be available if doctors confined all their activities to one geographic location, to one geographic area of some kind. Look at what is going to happen when we refer more and more people to different kinds of dental specialists. Are you going to improve the ways of communication between the specialists? or are you going to end up the way the medical specialties have? When they get so many different kinds of advice from so many different kinds of specialists, patients end up a part of the time coordinating the care.

It seems to me that there are lots of problems that are evolving and inevitably evolving as any profession gets more and more complicated. Medicine is so frightfully complicated, thank God, because this is the way we save lots of people's lives. We have not, however, at the same time that we have become increasingly specialized and increasingly productive of new miracles out of our laboratories and research centers, looked to see if we were organized in a way that would cut down the lag between the making of a discovery and its widespread application.

Representative Fogarty made a speech entitled "The Tragedy of Unused Medical Knowledge," in which he laid much of the difficulty about the lag between research and application at the door of organization. (This is the kind of thing I hint at when I suggest that it is time that perhaps the dental profession begins to anticipate some of the problems which it may have as it, too, specializes more and more and has more results coming in from its research laboratories.)

My fourth point is the cornerstone of all we do—really good research. I would like only to point out that, again, you are somewhat latecomers into the field of research, if one goes back in your history, as compared to physics, chemistry, medicine, or some other kinds of experimental science, but perhaps this gives you an advantage. You can learn a great many things quickly by teaming up with the chemists, the physicists, the basic scientists, the virologists, and the enzymatologists. All these people have something to contribute to your understanding of your profession.

It woud seem to me, too, that you have a great deal to add if you can simultaneously, with this so-called basic research, continue to investigate the application of these methods. Encourage further research in the organization of your services. Coming back in terms of your own group, I hope that you will energetically go at this question of the prevention of orthodontic difficulties as well as their amelioration.

It has given me great pleasure to be here, and I salute you for the really wonderful work that you have done. I would love to be here about forty years from now when somebody else reviews what has happened and predicts what the future holds. Thank you very much!

Dentofacial asymmetries and their clinical significance

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THERE are four types of dentofacial asymmetry which require special consideration in the management of malocclusion. They are (1) unilateral anteroposterior displacements, (2) vertical displacements, (3) lateral displacements, and (4) rotary displacements.

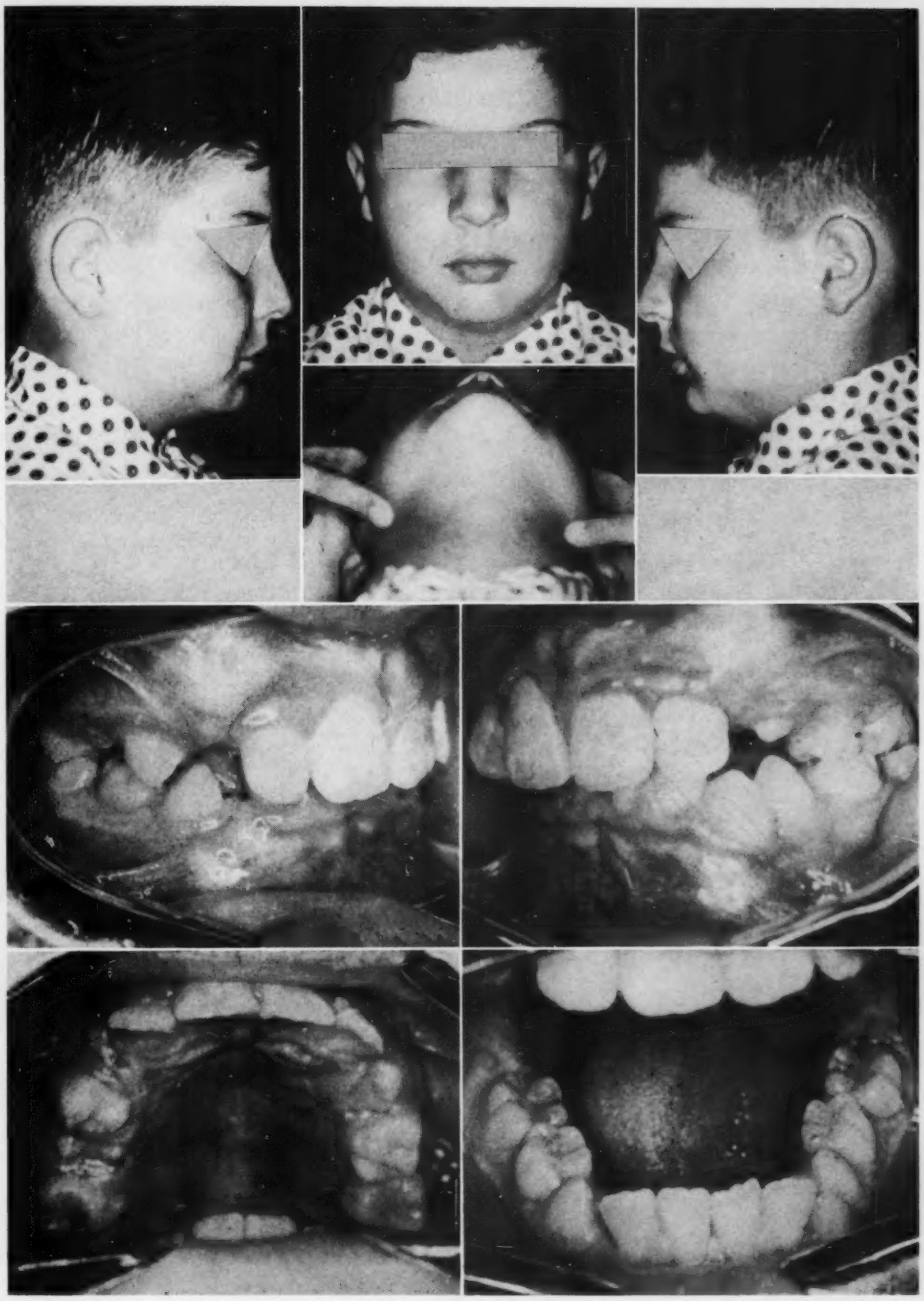
UNILATERAL ANTEROPOSTERIOR DISPLACEMENTS

Unilateral anteroposterior displacements are asymmetrical variations which result when there are horizontal anteroposterior differences in the size, shape, and/or position of parts on the two sides of the face. Fig. 1 shows an asymmetry resulting from a unilateral posterior displacement. The lateral, frontal, and inferior views of the face are shown in Fig. 1, *A*. The inferior view of the head and body of the mandible shows the variation. My assistant has placed the tips of her index fingers over the gonial angles on the right and left sides of the mandible. The distance from the right gonial angle to the tip of the patient's chin is less than the distance from the left gonial angle to the point of his chin. Examination of the maxilla reveals that there are no variations in the over-all length of the right body as compared to the left body.

The occlusal relationships in this patient's face are shown in Fig. 1, *B*. The right close-bite occlusal view reveals an Angle Class I molar relationship, and the left occlusal view reveals a Class II molar relationship. These occlusal relationships are the same at rest position. The occlusal view of the maxillary dental arch reveals no anteroposterior variation of the molars on the right side as compared to the molars on the left side. The occlusal view of the mandibular dental arch reveals that the mandibular right first molar, the second deciduous molar, and the first premolar are more anterior than the same teeth on the left side of the dental arch.

Presented before the Northeastern Society of Orthodontists, Hartford, Connecticut, Oct. 26, 1959, before the Michigan Orthodontic Forum, Lansing, Michigan, May 16, 1960, and at the annual meeting of the American Association of Orthodontists, Denver, Colorado, April 20, 1961.

A.



B.

Fig. 1. Photographs showing an asymmetry resulting from a unilateral posterior displacement of the left mandibular body.

In the case shown in Fig. 1 the asymmetry results from a variation in size and position of the left mandibular body as compared to the right mandibular body. The left gonial angle is displaced posteriorly, and the left mandibular body is longer than the right one. The right and left occlusal relationships are

different, for the left mandibular body supports its buccal teeth more posteriorly than the right mandibular body. Further examination of the intraoral photographs reveals that in the upper dental arch there is inadequate space for canine teeth. The same deficiency is shown in the mandibular right dental arch, but the left arch shows a much better space relationship. It is quite probable that the lower left canine will erupt into satisfactory alignment following loss of the lower left second deciduous molar. Extraction of first premolars on both sides of the upper dental arch and in the lower right buccal segment to provide adequate space for canines is a reasonable treatment consideration. On the other hand, extraction in the lower left buccal segment does not seem to be of advantage to the patient. In any event, and no matter what the treatment may be, it is evident that the malocclusion on the left side of the face will have to be managed in a different way from that on the right side. There is a unilateral anteroposterior asymmetry involving the size, shape, and position of the left mandibular body as compared to that on the right side.

VERTICAL DISPLACEMENTS

Vertical displacements are asymmetrical variations which result from height differences in size, shape, and/or form between dentofacial parts on the two sides of the face. Fig. 2*A* shows outline drawings of a face with an asymmetry which resulted from vertical displacements. The upper drawing in Fig. 2*A* shows the patient with his teeth in contact and lips together. The dotted outline

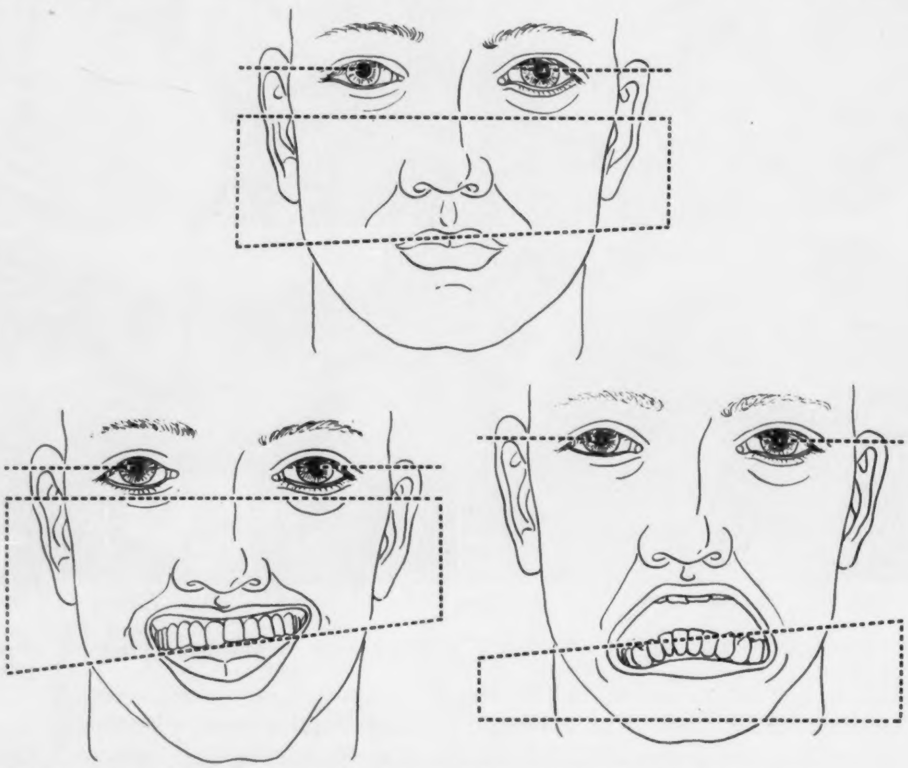


Fig. 2*A*. Drawings illustrating asymmetries resulting from vertical displacements.

illustrates the greater height of the ramus on the right side of the face as compared to that on the opposite side. The lower drawings in Fig. 2*A* illustrate the influence of the asymmetry upon the occlusal plane. On the patient's right side, where the maxillary body is larger and the mandibular ramus is longer, the occlusal plane is low. On the left side, where the maxillary body is smaller and the mandibular ramus is shorter, the occlusal plane is higher.

The nature of clinical problems in faces complicated by unilateral vertical displacements is shown in Fig. 2*B*. The front views of the patient's face in Fig. 2*B* reveal that the left eye is positively higher than the right eye. The left malar prominence, or cheek bone, is higher than the right malar prominence. The left ear is higher than the right ear. The left maxilla is larger than the right maxilla. The left ramus is longer than the right ramus. The intraoral occlusal views in Fig. 2*B* reveal a vertical variation of the occlusal plane on the left side of the dentition as compared to the occlusal plane on the right side of the dentition. The upper right-hand photograph shows the plane as related to other facial parts. This patient complained that the maxillary right cuspid flared slightly and was more prominent than the maxillary left cuspid at the end of treatment and retention. The occlusal views shown here were taken three months after the end of retention and ten months after removal of appliances.

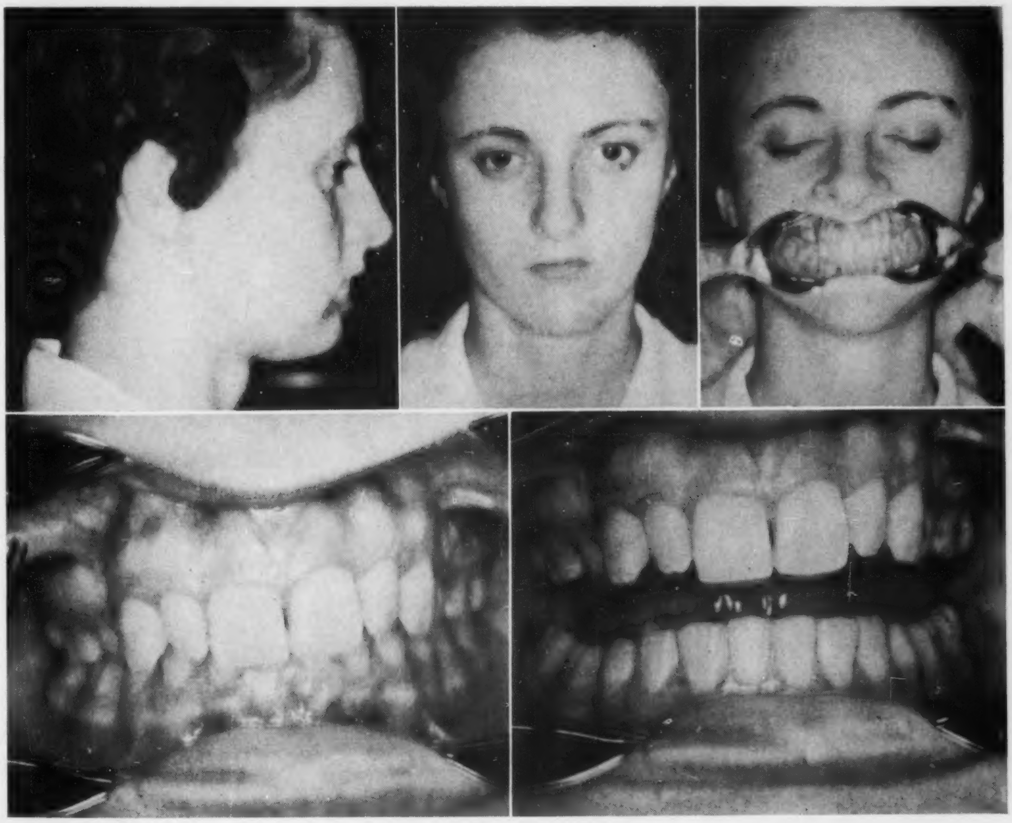
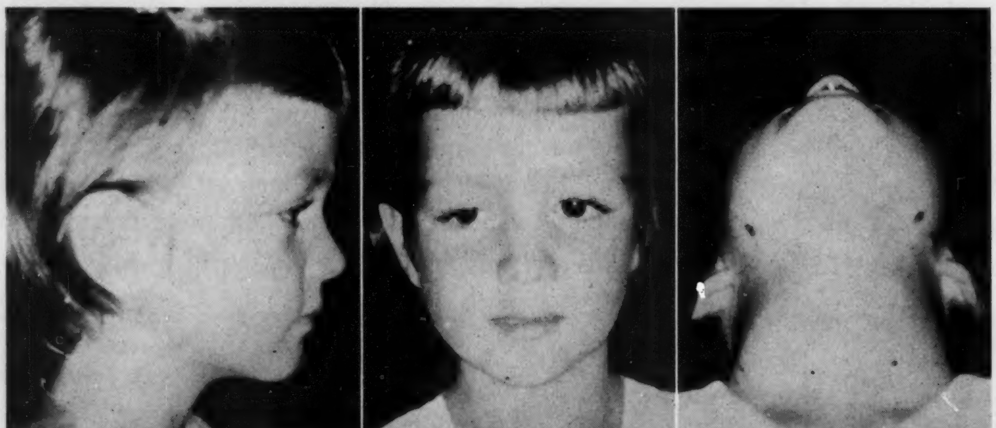


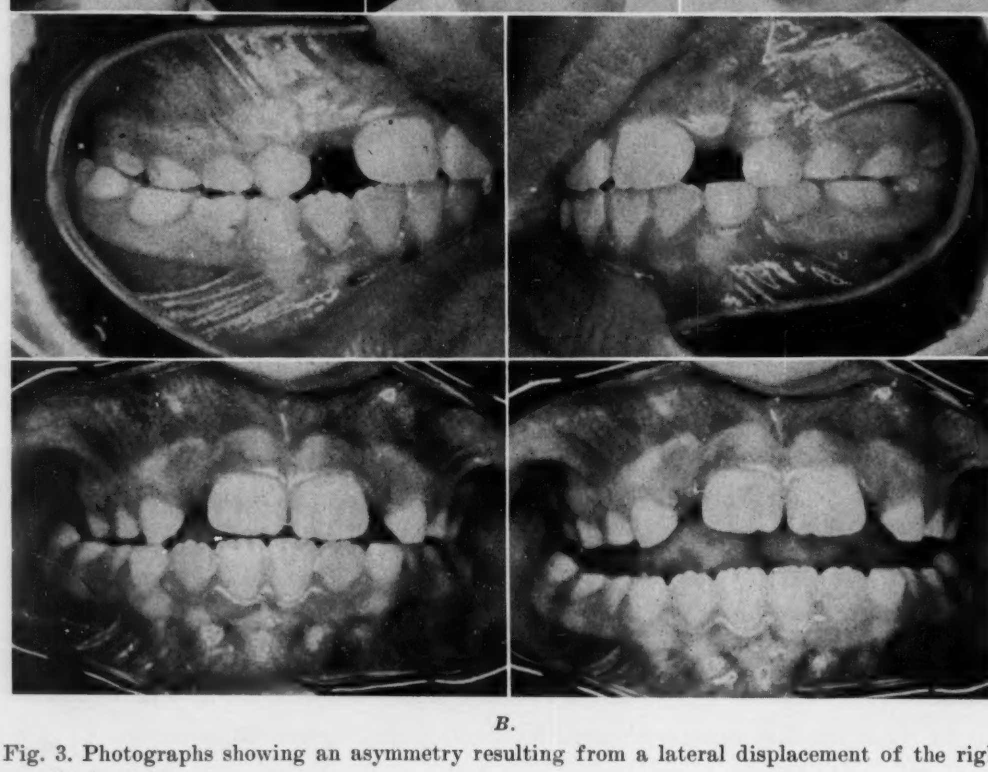
Fig. 2*B*. Photographs illustrating asymmetries resulting from vertical displacements.

Previous treatment included extraction of four first premolars, alignment of incisors, and space closure. The maxillary right cuspid maintained a satisfactory vertical and axial inclination as long as a Hawley retainer with a labial wire and a short, steep incline was worn continuously. However, after use of the appliance was reduced to "nights only," the maxillary right cuspid began to tilt labially.

A study of the occlusal relationships of the patient at closed-bite and at rest positions, as shown in Fig. 2*B,* reveals several interesting facts. The maxillary left cuspid has not modified following the end of retention. This is in contrast to the right side. The depth of bite and overlap of the left central incisor,

A.





B.

Fig. 3. Photographs showing an asymmetry resulting from a lateral displacement of the right mandibular body.

lateral incisor, and cuspid is less than the depth of bite and overlap of the corresponding teeth on the right side of the occlusion. The view at rest position reveals that the right mandibular cuspid shows more abrasion than the left cuspid. Apparently the right cuspid strikes harder against the lingual surface of its opponent during occlusion than does the lower cuspid on the left side. Occlusal equilibration of the right maxillary and mandibular cuspids could have relieved some of the occlusal stress against the lingual surface of the upper right cuspid. Nevertheless, following use of the retaining device, the teeth on the right side of the face, where the vertical dimension is shorter, have followed a different pattern than those on the left. The depth of bite, the axial inclination of incisors and cuspids, and the height of occlusal plane are different. While you may not have agreed with the manner in which the case was managed, you will recognize that the problem of manipulating and retaining tooth position and overbite is different on the right side of this patient's face than on the left.

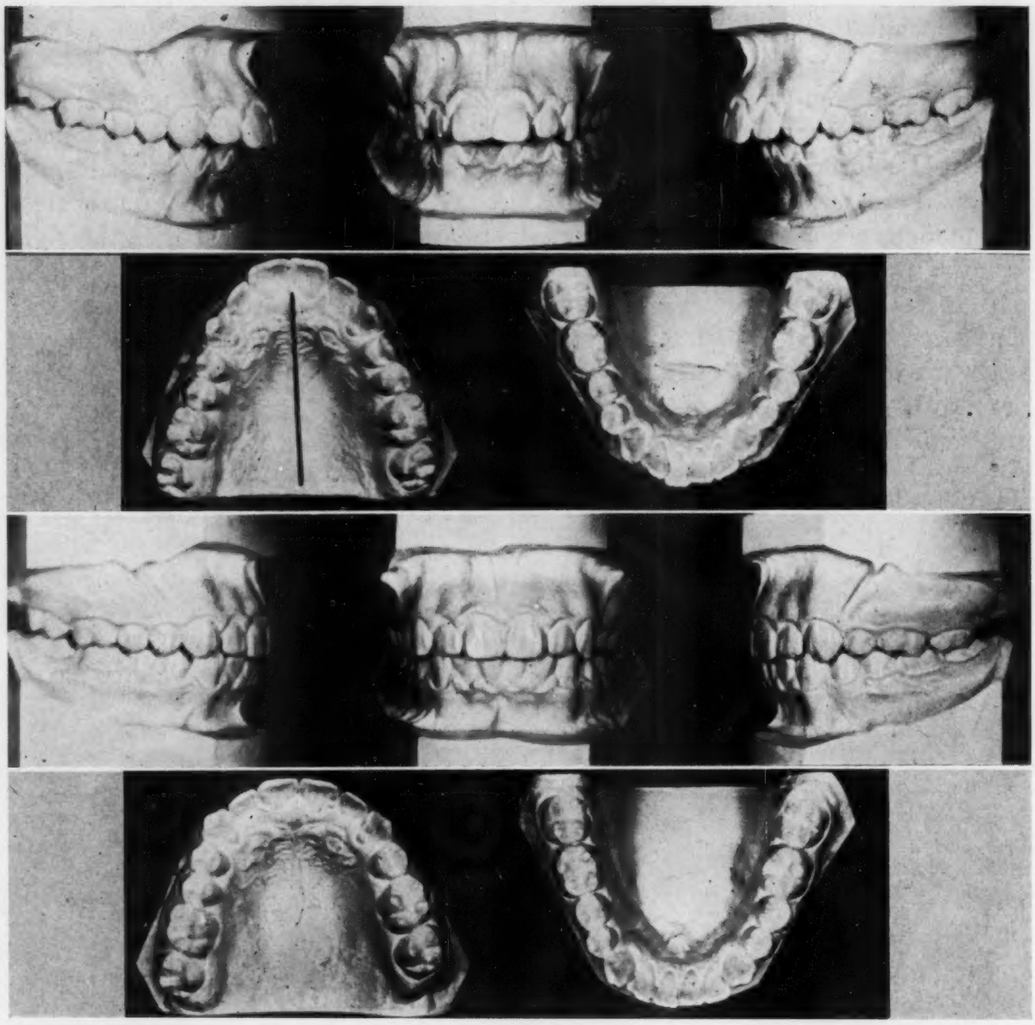
LATERAL DISPLACEMENTS

Lateral displacements are asymmetrical variations which result when there are horizontal lateral differences in size, shape, and/or position of dentofacial parts on one side of the face as compared to similar parts on the opposite side of the face. A patient with an asymmetry resulting from a lateral dentofacial displacement is shown in Fig. 3. The upper right hand photograph in Fig. 3, *A* shows that the chin point is displaced to the right of the midsagittal plane of the head. The left eye is vertical to the right eye. The right gonial angle is more lateral, relative to midsagittal plane, than the left gonial angle. The right maxillary body is larger than the left maxillary body. The right mandibular body is larger than the left mandibular body. The inferior view of the face shows other variations. The right gonial angle is more lateral and more posterior than the left gonial angle. The right ear is more posterior than the left ear.

Intraoral views of the patient's occlusion are shown in Fig. 3, *B*. The upper occlusal views reveal a cross-bite involving the right permanent molars, deciduous molars, and cuspids. On the left side, the occlusion is normal for its shape of development. The left-hand front intraoral view, with the teeth occluding, reveals that the mandibular incisor midline is to the right of the maxillary incisor midline. The right-hand front view shows the occlusal relationship at rest position. The buccolingual relationship of molars on the right and left, at rest, is the same as in the closed-bite position. The midline of the lower incisors is still to the right of the midline of the upper incisors.

The occlusion of the girl shown in Fig. 3 reflects a facial bone asymmetry. The dental cross-bite results from a horizontal lateral variation in the size and position of the right supporting apical bases. There is no shift of the mandible as a result of occlusal interferences. The relationship of the incisors and buccal teeth at rest, as compared to the closed-bite position, demonstrates this fact. Expansion of the maxillary dental arch or constriction of the mandibular dental arch to balance the occlusion is questionable treatment. Most likely, occlusal equilibration to facilitate a proper contact occlusion is the indicated procedure.

A.



B.

Fig. 4. Photographs of casts illustrating an asymmetry resulting from a rotary displacement of the maxilla.

ROTARY DISPLACEMENTS

Rotary displacements are asymmetrical variations which result from a displacement of the whole body of the maxilla or the whole body of the ramus. Unilateral size variations may or may not be present. Fig. 4 shows a malocclusion complicated by a rotation of the whole body of the maxilla. The casts shown in Fig. 4 are not gnathostatic records. However, they have been trimmed to approximate the relationship of the dentition to the other portions of the dentofacial complex and serve to illustrate the condition under discussion.

The occluded casts in Fig. 4, *A* show that the malocclusion is an Angle Class II, Division 1, Subdivision, left. The maxillary incisors are protrusive. There is an overjet of ½ inch. The occlusal views in these casts reveal that

1. **Asymmetry orbital point upwd. disp.**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

2. **Asymmetry malar process height**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

3. **Asymmetry malar process lat. disp.**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

4. **Asymmetry mand. ramus height**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

5. **Asymmetry mand. angle lat. disp.**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

6. **Asymmetry chin-closed lat. disp.**
   1. ~~abs.~~
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

7. **Asymmetry chin-rest lat. disp.**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

8. **Asymmetry dental height max.**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. ++

9. **Asymmetry dental height mand.**
   1. abs.
   2. rt. ?
   3. rt. +
   4. rt. ++
   5. lt. ?
   6. lt. +
   7. lt. +

10. **Asymmetry malar process post. disp.**
    1. abs.
    2. rt. ?
    3. rt. +
    4. rt. ++
    5. lt. ?
    6. lt. +
    7. lt. ++

11. **Asymmetry mand. body length**
    1. abs.
    2. rt. ?
    3. rt. +
    4. rt. ++
    5. lt. ?
    6. lt. +
    7. lt. ++

12. **Asymmetry palate rotary disp.**
    1. abs.
    2. rt. ?
    3. rt. +
    4. rt. ++
    5. lt. ?
    6. lt. +
    7. lt. ++

13. **Asymmetry mand. angle rotary disp.**
    1. abs.
    2. rt. ?
    3. rt. +
    4. rt. ++
    5. lt. ?
    6. lt. +
    7. lt. ++

Fig. 5. Observations and grading system for use in appraising dentofacial asymmetries.

neither dental arch has perfect symmetry, but the maxillary dental arch shows more deviation than the mandibular arch. During the clinical examination the relationship of the upper dentition to the patient's skull was observed. As shown here, the maxilla is rotated. The anterior portion of the upper arch is turned to the right. The median raphe is not parallel to the midsagittal plane; It angles to the right. At closed-bite position the upper and lower midlines do not coincide. In contrast, the mandible is more symmetrical than the maxilla when compared with adjacent facial parts.

The observations concerning asymmetry are of interest in planning treatment for this case. The dental arches are not small; yet both are narrow and trapezoidal in nature. There is little opportunity for adjustment of teeth or dental arches upon their apical bases. Because of the presence of the asymmetry, no attempt was made to move the left maxillary dental quadrant distally. Nor did we resort to extensive extraction procedures. Instead, we elected to "fit" the maxillary arch to its supporting base. As shown in Fig. 4, *B* we extracted the maxillary left first premolar and retruded the incisors and left canine into this space. The front view of these casts, taken one year after the end of treatment, reveals that the midlines now coincide.

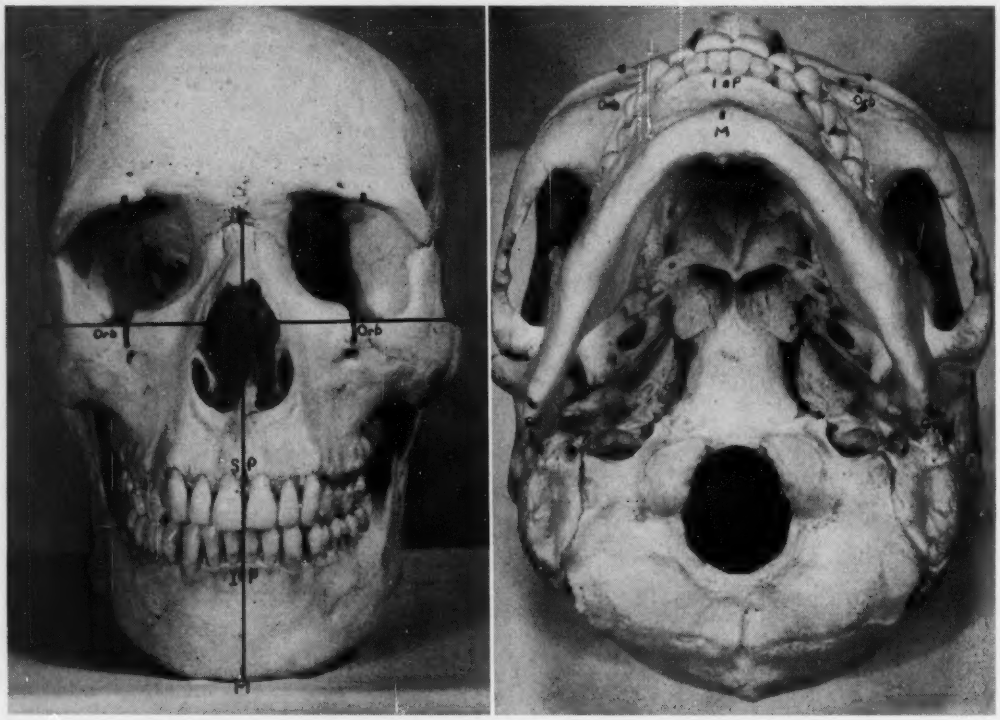


Fig. 6. Photographs of a skull showing landmarks and reference planes used to study dentofacial asymmetries.

IDENTIFICATION AND DESCRIPTION

A method of identifying and describing dentofacial asymmetries is illustrated in Figs. 5 and 6. Fig. 5 shows a table outlining a series of anthropologic observations to be made about the facial mass. These observations are made in studying the relationship of various anatomic landmarks on one side of the face to similar landmarks on the opposite side. The position of each right and left anatomic landmark is related to planes of reference. The establishment of reference planes and the relating of landmarks to these reference planes is an essential part of a dentofacial observational technique. Two planes of reference are used. These are demonstrated in Fig. 6, which shows front and inferior views of a Negro skull. The planes of reference are oriented upon the frontal view. The vertical plane is the midsagittal plane. It passes through points nasion (*N*) and anterior nasal spine (*ANS*). This skull is so symmetrical that as the midsagittal plane drops inferiorly it passes through superior prosthion (*SP*) and menton (*M*). The horizontal plane is the orbital plane. In these observations the orbital plane is described as being perpendicular to the midsagittal plane and passing through right orbitale (*Orb*). Again, the skull shown in Fig. 6 is so symmetrical that the extension of the orbital plane passes through left orbitale also.

The manner of making observations is illustrated in Fig. 5, which lists thirteen observations which are useful in studying dentofacial asymmetries. A series

of gradations, numbered 1 to 7, is listed below each observation or category. The gradations serve to assist the observer in studying the presence or absence of asymmetry. Also, they assist him in judging and grading the extent of asymmetry when it occurs. For example, let us examine observation 6 in Fig. 5. Observation 6 deals with the lateral relationship of chinpoint, or menton (*M*), to the midsagittal plane when the bite is closed. In the skull shown in Fig. 6 chinpoint falls directly on the midsagittal plane. To record this fact on the chart, a line has been drawn through *1.abs.* (*abs.* is the abbreviation for "absent.") The drawing of a line through a gradation is a method used by anthropologists to record an observation.

If *M*, or chinpoint, had been to the right of the midsagittal plane, a line would be drawn through *2.rt.?*, *3.rt.+*, or *4.rt.++*, depending upon the extent of deviation of *M* away from the midsagittal plane. *2.rt.?* records a very slight but noticeable variation. *2.rt.+* records a positive deviation. *2.rt.++* records an extreme variation. If chinpoint had been to the left of the midsagittal plane, gradations 5, 6, or 7 would have been selected.

Some orthodontists have suggested the use of actual measurements rather than the symbols *?*, +, or ++. However, there is another point of view in this regard. In studying the nature of malocclusion, we want to observe the manner in which the bones, teeth, and muscles go together to form the dentofacial complex. Significance centers about the interrelationship of facial parts. It is necessary to understand the extent of balance in size, shape, and/or form as it exists in and between the parts of the face. In these considerations signs and symbols are easily exchanged for numbers. Moreover, many dentofacial characteristics are not easily measured but can be graded with reasonable accuracy and maximum understanding. Defending this technique, Hooten[3] says: "Morphological features which can be observed and described but cannot be measured are probably of greater anthropological significance than numbers and indices." Since the identification and description of asymmetries requires a three-dimensional consideration, the use of direct observational procedures about the facial mass is a pertinent and effective method of observing and evaluating these variations.

Observations about *upward displacement of orbital point, malar process height, lateral displacement of the malar process, mandibular ramus height, lateral displacement of the mandibular angle, lateral displacement of the chin (bite closed), lateral displacement of the chin (at rest), dental height in the maxilla,* and *dental height in the mandible* are observed from the front of the face. *Mandibular body length, rotary displacement of the mandibular body, rotary displacement of the palate* and *posterior displacement of the malar process* are observed from the inferior view of the face.

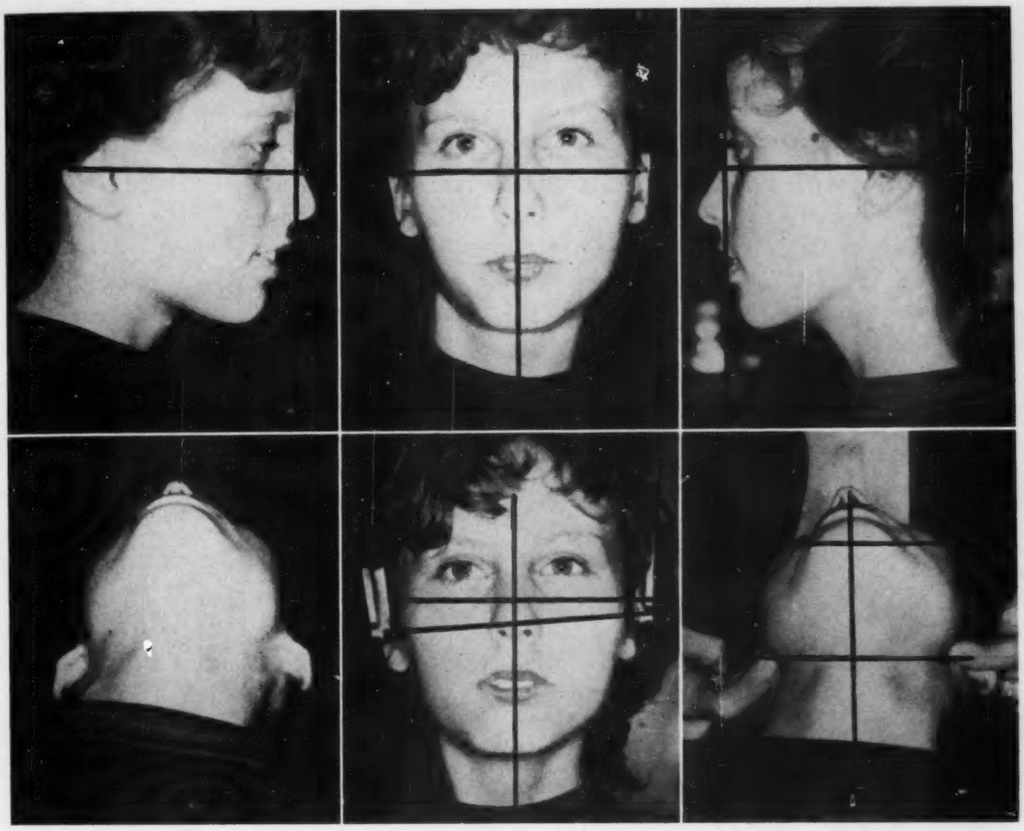
Direct observational procedures have been used for many years to study facial form. Lateral head examination techniques are common. Frontal examination procedures are shown and discussed. However, examination of the face from an inferior view has not been discussed. Inferior facial examinations are useful in making observations to evaluate the significance of dentofacial

asymmetries, and they are of particular importance in studying rotary and unilateral anteroposterior displacements. To facilitate inferior facial observations, the patient's head is tilted back in the headrest until Frankfort plane is perpendicular to the level of the floor upon which the examining chair rests. Landmarks and reference planes are shown on the inferior view of skull in Fig. 6. Observations about rotary displacements of the maxilla are made with the mouth open and with the observer looking directly at the palate. The median raphe is used to judge the presence or absence of a rotary displacement involving the maxilla. In judging the displacement, the entire length of the raphe from posterior region of the palate through to the anterior part of the maxilla must be studied. Minor deviations of the raphe in the premaxillary portion cannot be considered as symtomatic of rotary displacements of the whole maxilla. When the entire median raphe angles to the right or left of the midline, or the midsagittal plane, the maxilla is said to show a rotary displacement to the right or left, as the case may be. Observations about the mesial or distal relationship of buccal segments on either side of the maxilla serve to confirm the variation of rotary displacement. In the case of rotary displacements, it appears as though someone has taken the whole body of the maxilla and turned it to the right or to the left, as in the turning of a wheel. With unilateral anteroposterior displacement, only one side is forward. The whole maxilla is not involved.

Rotary displacements of the mandible are observed from an inferior view of the body of the mandible. The teeth are closed first in tight contact occlusion and then relaxed to rest position, to check for occlusal interferences which tend to distort the position of the mandible at closed bite. The point of the chin and the gonial angles are used to judge the rotary displacement of the mandible. In a true rotary displacement the point of the chin will be to the right or left of the midsagittal plane. In addition, one gonial angle will be more anterior than the gonial angle on the opposite side of the facial mass. Again, it appears as though someone has taken the whole body of the mandible and turned it to the right or to the left, as the case may be. In addition, there can be size variations of the bones on one side of the face as compared to the bones on the other side of the face. These size variations can combine with the rotary displacement to intensify and/or confuse the observations. Also, a rotary displacement of the maxilla and/or mandible can involve the whole side of a face. When the whole side of the face is involved, the occlusion will balance out with one side more than the other. In any event, these variations must be observed, graded, and evaluated in considering the total facial balance.

A combination of rotary and unilateral anterior displacements is shown in Fig. 7, which presents the frontal, lateral, and inferior views of the face of a 14-year-old girl. Frankfort, midsagittal, and orbital planes are oriented on the photographs. In addition, supplementary planes are drawn to permit comparisons with other landmarks. Fig. 7, *A* and *C* shows the difference between the right and left profiles in the girl's face. Profile differences are characteristic of asymmetries. Fig. 7, *B* and *D* reveals that the left eye, ear, malar process, gonial angle, porion, and related dentofacial parts are positively (+) displaced

A. B. C.



D. E. F.

Fig. 7. Photographs of a girl who has a rotary displacement of the mandible and an anterior displacement of the left maxilla.

superiorly and anteriorly. Also, these landmarks are questionably *(?)* more lateral than similar parts on the right side of the face. Close study of Fig. 7, *D* and *F* reveals another variation. The mandibular body exhibits a rotary displacement. The right and left mandibular bodies are of equal length. The whole bone is turned to the right. As a result, the left gonial angle is more anterior than the right. Fig. 7, *E* shows the patient with her head in a head positioner and with ear posts in the ear holes. Three planes of reference were placed on this photograph. Midsagittal and orbital planes were drawn first. Then a plane through porion on the right and porion on the left was added. As shown, the orbital plane and the porion plane are not parallel. The right ear is inferior and posterior in the facial mass when related to the left ear. The patient was required to tilt her head abnormally in the headrest to permit insertion of ear plugs in the ear holes. The discomfort was sufficient to bring tears to her eyes. Asymmetry of ear position on one side of the head as compared to the opposite side is common. However, asymmetry of ear position may or *may not* be associated with dentofacial asymmetry. This is a fact which should be determined in every orthodontic examination, particularly when oriented headfilms are used to describe the malocclusion.

Tracings of oriented posteroanterior headfilms of the girl in Fig. 7 are shown in Fig. 8. The four tracings are used to study the validity of reference planes and to determine their usefulness in appraising dentofacial asymmetry. Fig. 8, *A* shows a horizontal *PP* plane and a vertical plane through *CG* placed on the tracing. The vertical plane is perpendicular to *PP* plane. The vertical plane through *CG* falls lateral to *ANS* and *M*. Compare points *P* (porion) in this tracing with the same points on the face shown in Fig. 6. Point *P* on the

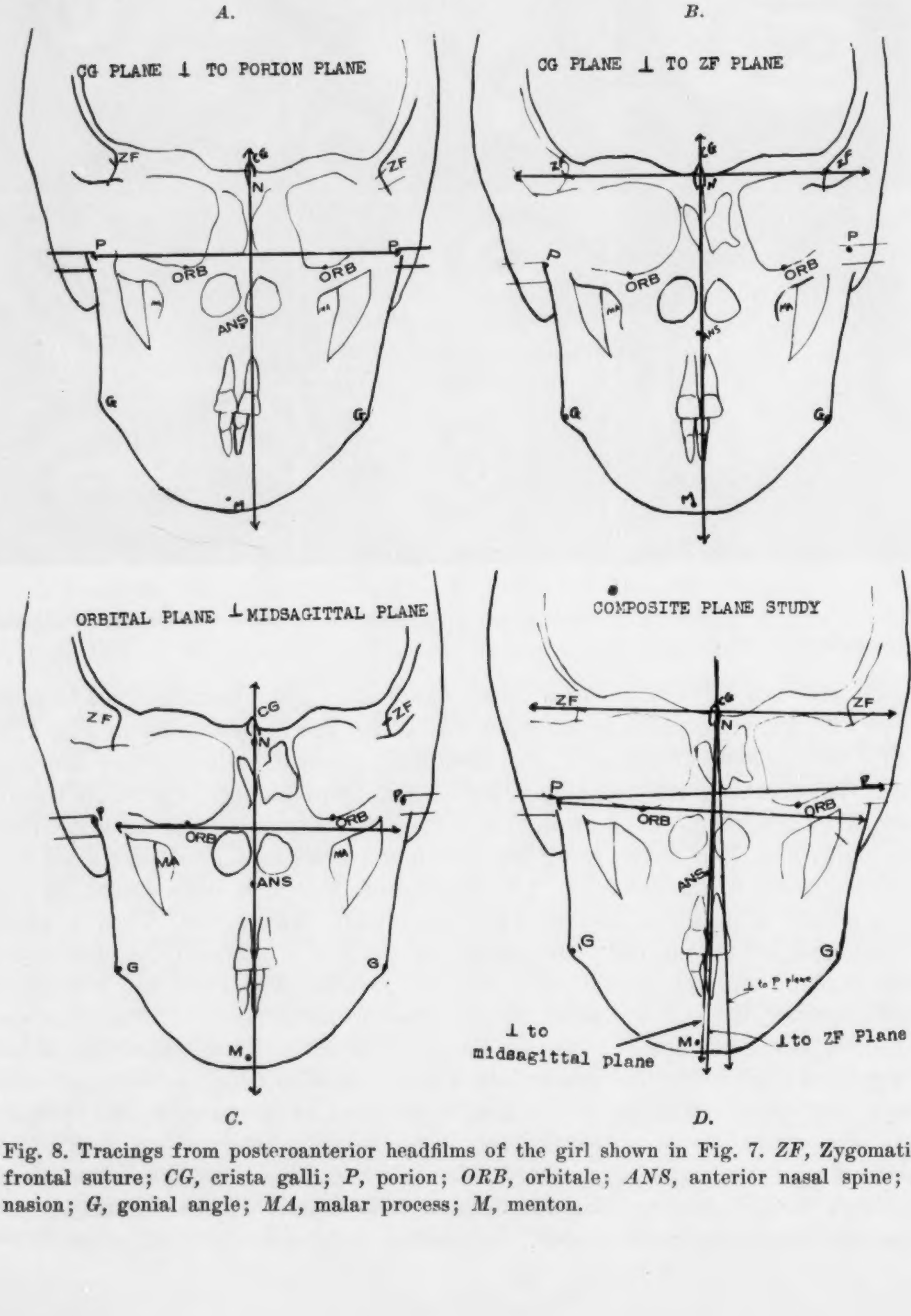


Fig. 8. Tracings from posteroanterior headfilms of the girl shown in Fig. 7. *ZF*, Zygomaticofrontal suture; *CG*, crista galli; *P*, porion; *ORB*, orbitale; *ANS*, anterior nasal spine; *N*, nasion; *G*, gonial angle; *MA*, malar process; *M*, menton.

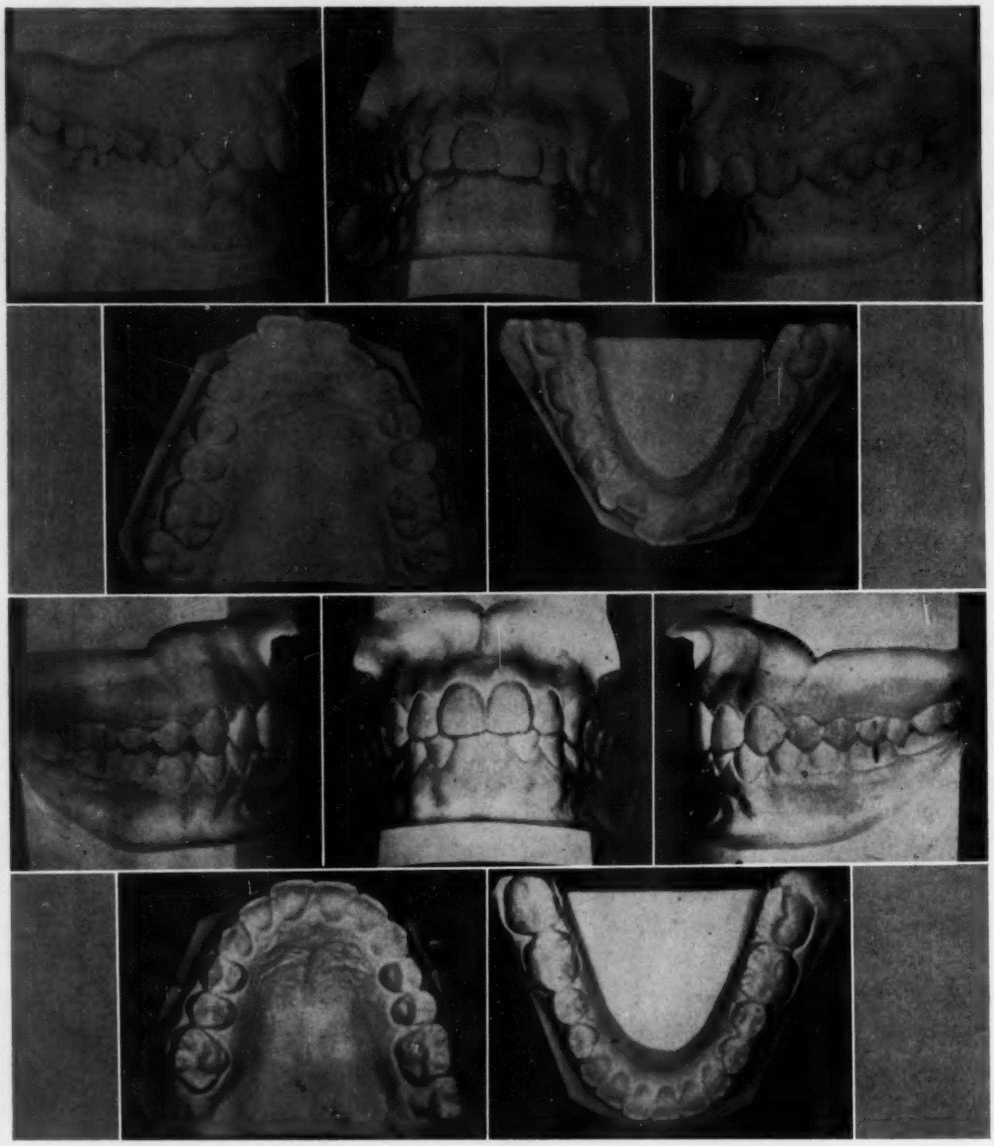
left is higher than point *P* on the right. Therefore, any line perpendicular to a plane through these points assumes the asymmetry and loses much of its validity. Fig. 8, *B* shows a horizontal *ZF* plane and a vertical plane through *CG* and perpendicular to *ZF* plane. *ZF* plane and the vertical plane through point *CG* were selected and used by Harvold[2] as reference planes to determine the midline of the facial mass in cleft palate children in whom landmarks are distorted. Harvold called the vertical perpendicular plane the "X line." He found that *ZF* and *CG* points are more reliable than landmarks taken from the facial mass. These points are a part of the cranial base and are outside the facial mass. Harvold observed that the vertical X line through *CG* and perpendicular to the *ZF* plane closely approximates the anatomic midsagittal plane of the head. Also, he noted that points *N* and *ANS* fall on or closely approximate his X line in 90 per cent of the normal cases.

In this discussion our interest centers about the use of points *N* and *ANS* as reference points in determining the midsagittal plane for direct observations about asymmetries. *N* and *ANS* can be palpated with the fingertip and can be identified on the external surface of the face. To examine the reliability of this statement, midsagittal and oribital planes, as shown on the face of the girl in Fig. 7, were placed on the posteroanterior tracing. These planes are shown in Fig. 8, *C*. Here we see some of the asymmetries described in Fig. 7. The left eye, ear, and gonial angles are superior. Chinpoint, or *M*, is to right of the midline. Fig. 8, *D* shows a composite of the tracings shown in *A*, *B*, and *C*. The relationship of reference planes and landmarks should be studied. As indicated, the vertical plane through *CG* and the midsagittal plane drawn through *N* and *ANS* closely approximate one another. The vertical plane perpendicular to the *PP* plane falls to the left. It is not useful in studying the nature of the asymmetry.

Tracings of lateral headfilms of the patient shown in Fig. 7 are not presented in this article. These records were reviewed, however, and they revealed two characteristics of the asymmetry. The posterior borders of the rami superimpose one upon the other. Also, the first molars superimpose over each other. For this reason, the occlusal relationships as seen in the roentgenograms do not show the true nature of the malocclusion. The malocclusion, shown in Fig. 9, *A*, is a Class II, Division 1 distoclusion. It reflects the asymmetry of facial bones. Both upper and lower left dental buccal segments are anterior to those on the right side. The mandibular left dental arch shows more variation than the opposing left maxillary teeth. The rotary displacement of the right mandibular body and dental arch has positioned these parts to the distal and lingual sides. There is a full-cusp distoclusion. In contrast, the left mandibular body and dental arch are positioned forward and buccally. The left first molars are close to neutroclusion.

Functional factors are also at work in the dentition shown in Fig. 9, *A*. Observe the spacing between the right maxillary premolar. In contrast, the left maxillary premolars are in buccal version. During closure the maxillary left premolars acted as an occlusal interference and forced the mandible to shift

A.



B.

Fig. 9. Casts taken before and after treatment, showing occlusal relationships of the girl shown in Fig. 7.

to the right. In view of the mandibular shift, some orthodontists may believe that the malocclusion shown in Fig. 9, *A* is entirely functional in nature. However, treatment experience revealed that the malocclusion was due partly to functional factors, partly to skeletal asymmetry, and, to a minor degree, partly to a deficiency. It is, in fact, true in all cases that a diagnosis is not complete until it is substantiated by treatment experience. In this case the treatment experience identified the extent and significance of the asymmetry. Expansion

of the mandibular left premolars and constriction of the maxillary left premolars effected a correction of the left occlusal relationship, as shown in Fig. 9, *B*. The change occurred immediately. Part of the correction resulted when the mandible shifted to a correct closure pattern. On the patient's right side, however, the problem was different.

In considering the nature of treatment for the right side of the dentition shown in Fig. 9, *B*, it is important to remember that the right side of the maxilla is smaller than the left side. In addition, the rotary displacement of the mandible was sufficient to effect a real distoclusion of the right molars. In this circumstance, I elected to move the maxillary right first molar distally. As shown in Fig. 9, *A*, the second molar had erupted. The third molar, though unerupted, was in close approximal relationship to the second molar. Accordingly, the maxillary right second molar was extracted to reduce the excess tooth structure and to facilitate distal movement of the first molar. At this point I made a treatment error. Although the first molar shifted distally, it was not permitted to settle satisfactorily. As shown in the casts in Fig. 9, *B*, the lower right second molar extruded, preventing complete distal positioning of the upper first molar. Moreover, occlusal stresses forced this tooth to rotate again following treatment. The mandibular right second molar should have been maintained in proper occlusion and not allowed to extrude. Possibly the tooth should have been extracted. At any rate, it is evident that the asymmetry was a major factor in the malocclusion and necessitated a different treatment approach for the right side of the dentition than for the left.

CONCLUSION

In the foregoing discussion dentofacial asymmetries requiring special treatment consideration are presented, and the nature of the problems involved is discussed. A method of identifying, describing, and evaluating dentofacial asymmetries is shown and illustrated. Finally, the management of a dentition complicated by a rotary and unilateral anterior displacement is presented.

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Recent developments in biologic studies on the osseous system

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THE PROPOSED topic of recent advances in biologic investigations on the skeletal tissues is one of great latitude. The selection of representative work of interest and significance for analysis here becomes a matter subject to opinion. There has been a marked resurgence of interest in hard tissues over the past two decades, for which one can account only incompletely. The advances in clinical techniques and capacities for the rebuilding of bodily defects are among the prime motives. The increasing control being gained over metabolic processes, especially nutritional and endocrine processes, has stimulated interest in these tissues which are so responsive to so many metabolic disturbances. The advances in radiobiology, especially in radioisotopes of minerals and products of nuclear fission, have attracted attention to a tissue which, of all bodily substances, seems the most avid for these radioactive substances and offers some of the greatest potential for serious damage in overexposure. Doubtless, also, this field has profited greatly, as has all of biologic research, from the availability of new and highly sensitive instruments and procedures which physicists and chemists have devised. These and many other factors have resulted in the growing frequency of specialty conferences and study sessions in which those in the health sciences are joined by crystallographers and biophysicists, by ichthyologists and physical anthropologists in common interest. Rather than listing the areas of activity, many of which are rapidly turned to account in diagnostic and therapeutic practice, it is appropriate to cite several recent monographs and conference reports which provide such a survey.[11, 24, 27, 32, 33]

In selecting from this topic a small number of active areas for exploration in some detail, a choice has been made of material related to skeletal development, to nutritional regulation (both vitamins and minerals), and to endocrine influences on the hard tissues. A fourth area—that of mechanical aspects of

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hard tissues—is mentioned briefly to draw attention to the growing literature in the field. Where possible, interest is focused on head structures; the approach is chiefly from the standpoint of the anatomist and experimental pathologist.

DEVELOPMENTAL INFLUENCES

Great impetus for the study of skeletal development results from the expanding study of congenital abnormalities. In this active field, research is encouraged both by new concepts of causation and by the increasing realization of the acute public health problem presented by significant numbers of deformed and disabled children.[35] For decades the causation of congenital defects was sought chiefly in hereditary factors or developmental accidents. In the mid-1930's the demonstration by Hale[18] (working on vitamin A deficiency in swine) of facial and palatal defects opened the question of alterations of the maternal environment during pregnancy. Early in the next decade, Warkany and colleagues[34] provided firmer ground, especially with the production of chondrodystrophy in rat young born to riboflavin-deficient mothers. The past two decades have shown the very great range of alterations of maternal circumstances in pregnancy which result in widely varied forms of congenital disorders of the young.[22] As an illustration, cleft palate can be induced experimentally by at least twenty different maternal situations (dietary or endocrine deficiency or excess, anoxia, radiation, toxins, and mechanical intervention with the uterus). In fact, cleft palate is one of the defects most easily produced experimentally.[26] In most instances, its occurrence is sporadic or in low frequency. However, in two circumstances—excess of vitamin A and deficiency of a vitamin of the B group, folic or pteroylglutamic acid (PGA)—the incidence in rats approaches 100 per cent under defined circumstances. An equally high incidence results from cortisone injections in strains of mice genetically predisposed to cleft palate and directs attention to the interplay of hereditary and environmental influences.

An acute PGA dietary deficiency may be induced in pregnant rats by omitting this vitamin from the diet, giving an antimetabolite (that is, a chemical analogue of the vitamin which is physiologically inert), and suppressing intestinal bacterial synthesis of the vitamin by use of succinyl sulfathiazole.[3] If this is done after the middle of the twenty-one day gestation period (that is, from the twelfth day on), the young born are indistinguishable from normal. Instituting the deficiency only one day earlier results in more than 95 per cent of the young being born with cleft palates of an apparently simple form. Starting still one day earlier (the tenth day), not only do all young have cleft palate, but one-fifth of them have labial and facial defects. Still earlier in pregnancy, the length of time during which the mother must experience the deficiency is shortened; a two-day deficiency from the ninth to the eleventh day results in a high incidence of both facial and palatal deformities. Moreover, under these earlier deficiencies, some of the deformities are complex and bizarre.

The high expectancy of palatal defect under a maternal deficiency starting on the eleventh day makes it possible to examine fetuses in which the palatal precursors are still forming, with a strong likelihood that such young would

have shown cleft palate at birth had the pregnancy not been interrupted. In comparing them with normal young of the same ages, the presumption is reasonable that, whatever the morphology in deficient fetuses, it is a stage in the development of a palatal defect. The normal sequence of appearances of the nasal-oral cavity in developing a palatal shelf in rats corresponds closely with those described in human beings. Comparison of sections of normal and PGA-deficient rat fetuses in a standardized frontal section plane has shown that, even though the maternal deficiency began on the eleventh day, no substantial difference between control and deficient young (except for a slight stunting of the latter) was seen through the fifteenth day. By the sixteenth day, however, a marked difference was found. The transposition of the position of the tongue and the palatine shelves which normally occurs by this time did not occur in the deficient fetuses; the tongue remained high in the mouth, in contact with the median nasal septum and with the palatine processes trapped below it. Thereafter, while the normal young were proceeding with the orderly development of a soft tissue and bony palatal partition, in the deficient young the early (and now abnormal) relationships persisted until the nineteenth day. While the tongue could eventually be found lower in the mouth, the palatal processes remained unfused with each other and with the nasal septum, rather than achieving a delayed union. Examination of other regions of the heads of these young showed that they were micrognathic; in the mandibular region, Meckel's cartilage and adjacent osteogenesis were delayed or defective. The mandible itself was short and poorly arched, both laterally and dorsoventrally. Under these circumstances, it seems possible that defective development of the mandible may have been associated in the failure of the tongue to descend and in the lack of subsequent transposition of the lateral palatine processes into a position suitable for fusion. However, this simple explanation does not suffice for the more complex deformities seen under slightly changed experimental conditions. Especially in two- or three-day deficiencies early in pregnancy, conditions of excessive breadth of the head and stunting of the lateral palatine processes may be seen. An infrequent but bizarre deformity of interest shows the nasal process so broadened as almost to form a false palate; occasionally this broadening incorporates the roots of an incisor tooth which is now far from its normal place (in rats) lateral to the nasal cavities. Such a displacement could be explained by an extremely early disruption of the "mosaic" of cells before head formation, as such, has been well started.

In apparent contrast to the numerous instances of experimentally induced cleft palate, facial malformations have been less frequently reported. It is especially interesting, therefore, that PGA deficiency early in pregnancy results in a high incidence and wide variety of this type of malformation.[1] Defects include median labial cleft, harelip (unilateral or bilateral), oblique facial clefts, bifid nose, and grotesque extremes of facial dysgenesis. In fact, the variety is so great that it has not yet been possible to provide the same type of analysis that was used with the simpler deformities. Without having a certainty of what the end result would have been in the newborn, it is difficult to analyze the defective morphogenetic processes in individual fetuses, even though one

is assured that some defect is in process. In gross and histologic studies on the normal development of the rat face, one can trace the sequence and time of various fusions and mergings of the embryonic processes, always remaining aware that the success of some one event may be dependent on a successful preceding activity. One can also classify the various facial malformations which have been listed according to which of these events seems to have failed. If, from the incidence of these various malformations, there are then selected those which resulted from a deficiency of two or three days starting on the tenth day of pregnancy, it is found that most of them are midline defects (median labial cleft, bifid nose, etc.) and are primarily referable to the failure of events which would normally have been completed on day 14½ to 15½ (that is, at a time when the mother had been returned to a fully adequate diet). When the deficiency started one day earlier, on the ninth day, and was terminated on the eleventh day by return to a complete diet, the majority of defects are lateral to the midline (harelip, wolf-snout, oblique facial clefts, etc.); this is attributable to the failure of morphogenetic mechanisms normally occurring on the thirteenth and fourteenth days. Bifid mandible has been found rarely; the normal time of mandibular union is approximately day 12½, and a deficiency on day 9 to 11 was apparently not early enough to impair this process.

From these and similar studies of the abnormalities found elsewhere in the bodies of such fetuses, it must be concluded that this maternal dietary deficiency, even when experienced for only a brief (but critical) time in the pregnancy, resulted in some biochemical alteration several days before the morphologic consequences could be observed. Quite possibly the problem lies in nucleic acid syntheses, for this vitamin is known to be important in some phases of this process. To the question of the application of these findings to human beings, most experimenters in teratology desire to defer comment, feeling that the basis for transfer of laboratory findings to human beings is still inadequate. It is of interest that in two recorded cases a PGA antimetabolite was used in unsuccessful attempts at abortion and that both mothers delivered progeny with cleft palate and other congenital defects.

It should be noted that congenital abnormalities of dental formation and occlusion and of facial bone development as a result of maternal riboflavin deficiency in rats have been reported recently.[13]

NUTRITIONAL INFLUENCES

The very active work in this field has been broadly summarized by Follis.[16] In the present report, two experiments on mineral requirements may be cited. Like the preceding, both involve maternal-fetal relationships. In a study on the distribution of calcium between the skeletons of the mother and her offspring, rat mothers were placed, from the first day of gestation, on a diet which was extremely low in calcium but which provided all other known nutritional requirements. This diet was continued throughout pregnancy and thereafter until the young were weaned on the twenty-first day after birth. X-rays and histologic sections of the skeletons were studied to determine the adequacy of skeletal growth and maturation under these circumstances. Both in length of bones and

in the state of their maturity (that is, the acquisition of epiphyseal ossification centers), the young were found to be of normal status. The mothers, being full-grown and of normal epiphyseal maturity at the start of the experiment, suffered no retardation.

Detection of rarefaction of the bones was of special interest. In most of the body, whether of mother or offspring, visual inspection of x-rays gave inconclusive results, chiefly because of the density of overlying flesh shadows. (Tail vertebrae provided a better opportunity for showing rarefaction, because of the scanty supervening tissue.) However, it was possible to obtain photo-densitometer readings on bones (excluding readings of the flesh shadows by optical procedures) which represented the bone demineralization. Verification of the sensitivity of the readings was obtained by making photo-densitometer readings on dissected bones, which were then ashed to determine the actual mineral content. Under these circumstances, it appeared that the calcium deficiency reduced the mineral density of the maternal bone tissue to 73 per cent of normal. (In a related study, in which the calcium deficiency extended only through the nursing period, the mineral density was depleted to 83 per cent of normal.) In contrast, the x-ray density of the bones of all offspring remained essentially within normal limits.

Histologically, cortical bone from calcium-deficient mothers showed two kinds of changes. In much of the bone, a meshwork of spaces appeared. At the edges of such lesions it was clear that osteoclasts had proliferated in the perivascular spaces; deeper, in the central parts of these lesions, there was active bone resorption and, in addition, some osteoblasts had appeared, and small amounts of recently formed bone were overlaid on the irregularly eroded older bone. Elsewhere there were seen well-delimited areas where cortical bone was completely lacking and the marrow was in contact with periosteum. Such regions probably accounted for the sharply circumscribed areas of rarefaction which had been observed radiographically in the shafts of long bones.

The contrast between this and the preceding experiments is noteworthy in the face of the often-made generalization that offspring are protected against dietary insufficiency by the maternal organism. In the PGA deficiency, the young suffered but the mother appeared to experience no difficulty. In the calcium deficiency, the needs of the young were accommodated; in the partitioning of the available supply, the mother bore the burden of the deficiency. The mechanisms for adjustment of this distribution would bear considerable study.

In considering mineral needs, it is of interest that much less is known of the trace minerals than of calcium. (Exceptions are iodine, with respect to thyroid function, and cobalt and copper, in connection with anemias.) Veterinary medicine has provided some basic problems in trace elements and skeletal development, and fruitful experimentation on laboratory animals is under way.[31] Manganese deficiency is one such area; Wolbach and Hegsted[36] have reported that lack of this trace element markedly affects endochondral bone development. In our laboratory, growth delay, slight retardation of epiphyseal maturation, defective epiphyseal cartilage plates, kyphosis, and deformed extremities were observed in rats.[17] The program of Hurley and associates[21] has shown that this

element is required during pregnancy, and that unless it is available at specific times the young born will subsequently develop ataxia and postural disorders. Abnormal cranial form and delay in ossification of the inner ear are also reported.[21] It is possible that some explanations for the ataxia may be found in histologic studies of the development of the otic capsule and labyrinth.

In maternal manganese deficiency it will be noted that the state of maternal health allows reproduction and lactation but that the offspring experience deformities, at least some of which are congenital.

ENDOCRINE REGULATION

In turning from early development and from nutritional factors influencing the skeleton, it is of interest to examine especially some work on skull development in rats. The studies of Evans, Simpson, Becks, and co-workers[2, 6, 28] on clarifying interrelationships of pituitary and other hormones affecting development of long bones have been presented on several occasions before such conferences as this. In brief, is has proved possible to distinguish between endocrine stimulation of *growth* of long bones (as indicated by gain in length and thickness and by histologic demonstration of chondrogenesis at epiphyseal cartilage plates) and stimulation of *maturation* (as indicated by epiphyseal "closure" or "fusion," shown radiologically or histologically). The studies mentioned were usually conducted on rats whose pituitary or thyroid gland had been removed and replaced with appropriate hormonal therapeutic combinations. Generally, it appeared that pituitary growth hormone induced growth in length and girth of bones but did not enhance maturation. Thyroid hormone promoted maturation when given alone; given with growth hormone, it augmented the growth-promoting effects.[28]

The skull has not been as thoroughly studied as some of the long bones, although two observations require remarks. In one series of experiments designed to test the effectiveness of growth hormone in inducing intramembranous ossification,[29] the calvarium was removed, leaving the dura mater. In normal rats, it regenerated almost completely in a month, even re-establishing suture patterns. After hypophysectomy, no regeneration followed removal of the calvarium unless growth hormone was administered, in which case regeneration followed the normal course. In another series of experiments, dealing with gigantism resulting from excess growth hormone, the skull appeared to show some acromegalic features.[4] Bone thickness increased markedly, and ruggedness became extreme, especially at muscle attachments. With mandibular overgrowth, dental occlusion was much disturbed. The mandibular molars were advanced until their occlusion was one tooth ahead of the normal level; the incisors showed abnormal curvature and excessive erosion of the occlusal surfaces. (It will be remembered that rodent incisors possess special characteristics of continuous growth and erosion which modify their response to malocclusion.) An important factor in the mandibular alterations probably lies in the capacity of its condylar cartilage to respond to growth hormone, even in adult life.[5]

It was desired, however, to make a more comprehensive survey of endocrine factors regulating the head form than has been available. The development of

the skull is, of course, a much more complex phenomenon than the development of a long bone. The requirements of its neural, alimentary, respiratory, and other functions must be correlated; genetic, nutritional, hormonal, and mechanical factors are interwoven in the integration, which produces a structural and functional whole from a large series of separate bones. Before analyzing activities at individual growth centers, it is desirable to know in some detail what regions and dimensions are experiencing differential growth.

A craniostat, somewhat reminiscent of the Broadbent-Bolton cephalometric instrument, was devised to allow for positioning of the heads of anesthetized animals in constant and reproducible positions so that lateral and ventrodorsal views could be made. The external auditory meatuses and the gingival margin of the upper interincisal space comprised a three-point fixation system for the heads of living, anesthetized rats. The same animals could be observed repeatedly, and series of observations on appreciable numbers of animals have been conducted for periods of over eight months. The use of fine-grain x-ray film allowed measurements to be made in standardized planes to 0.1 mm.

The main study to be mentioned here was conducted on female rats to follow normal skull development and its alteration following early hypophysectomy. The observations started one week after weaning and continued well into adulthood, ending at 280 days of age. At the outset, simple absolute measurements and ratios were chosen rather than some of the more sophisticated evaluations familiar in human cephalometry.

Both total skull length and skull width (bizygomatic) continued to increase throughout the observation period, but the rate of increase was very much reduced in hypophysectomized animals. It was, however, statistically significant; the validity of the finding gains meaning if one recalls that the same animals were under study throughout the experiment. In these over-all dimensions the same proportionality was retained throughout; that is, within the limits of measuring error the skull width remained 51 per cent of skull length.

When components of this growth were examined, differences in proportion became clear. Normally, for example, cranial length (that is, length of the brain case) continued to increase into adulthood, while growth in cranial width was very slight after 28 days. In hypophysectomized animals, cranial length growth was retarded. When the cranial index (cranial width times 100, divided by length) was computed in normal animals, it dropped from the infantile value of 81 to reach 69 in adults. After hypophysectomy, stasis in both dimensions resulted in retention of the infantile value (80 at the end of the same period).

Normally, cranial height, like cranial width, showed little advance after infancy, and the height-length index therefore dropped from the infantile 51 to approximately 42 in adults. In hypophysectomized animals cranial height actually underwent a slight but statistically significant increase. This doming of the skull has been recognized previously; Mortimer[25] considered it one of the best criteria of complete hypophysectomy. It is, perhaps, attributable to the fact that, although bony growth is markedly retarded soon after hypophysectomy, brain growth continues at a normal rate for another month before reaching

adult size at approximately 60 to 70 days of age; it is likely that this is a compensatory adjustment of brain-case dimensions.

The relationship of the facial and cranial lengths was of special interest. In both groups of rats, the facial structures were initially shorter than the cranial ones, reflecting the short-snouted or snub-nosed heads of younger animals. Normally, facial growth was more rapid than cranial growth; the two segments became of equal length at 60 days, and thereafter facial structures predominated in influencing total skull length. In hypophysectomized animals, however, this facial growth was retarded almost as much as cranial growth. The facial component never came to equal the cranial component; as a result, a juvenile, immature head form always characterized the hypophysectomized rat. The proportion attained provided a finding of some interest. When the ratio of facial length times 100 divided by cranial length was computed, normal animals had an index of 89 at 1 month of age and 100 at 60 days (as intimated previously), and they ultimately attained an index of 104 (reflecting the eventual predominance of facial skeleton). Hypophysectomized animals, however, stopped at 95. By interpolation on the normal curve of this index, it appears that this value was characteristic of normal animals at 45 days of age. It has been known for some time that the bone age, as assessed by epiphyseal status, is also virtually arrested at forty-five days following hypophysectomy at 28 days of age.[2, 27] This raises the question of whether this is coincidence or whether these faciocranial proportions comprise a sensitive indicator of maturation, as do the epiphyses. In other words, is it possible to employ the values of these various ratios, which express head proportions, and obtain an expression of degree of maturity which takes into account the differential growth of the various portions of the skull?

In Fig. 1, the three ratios mentioned, all of which have cranial length as a base, have been plotted side by side for several ages and experimental circumstances; the shifting emphasis on their various heights forms appreciable differences in the profiles. To test the possibility that these might be "maturity profiles," similar profiles were constructed for some critical experimental circumstances, in particular for hypophysectomized rats receiving replacement therapy with thyroxin, growth hormone, or the combination. (It will be remembered that maturation and growth of long bones were differentially affected by such treatment.) The "profiles" of these animals were then studied to see whether the shifts resulting from treatment corresponded to retention of juvenile characteristics or to advance toward adult proportions. Although much work remains to be done in this evaluation, it may be said that (1) the slight growth resulting from thyroxin administration alone was differential to the extent that it effected a shift in the direction of adult proportions, (2) the appreciable growth induced by growth hormone accentuated the juvenile proportions of the brain case but altered facial development in the adult direction, and (3) when both hormones were given substantial growth was encountered, all of which tended to the attainment of adult proportions. Thus, in spite of the complexity of factors influencing over-all skull development, it may eventually be demonstrable that the endocrine influences are exerted in ways substantially consistent with their effects on the appendicular skeleton.

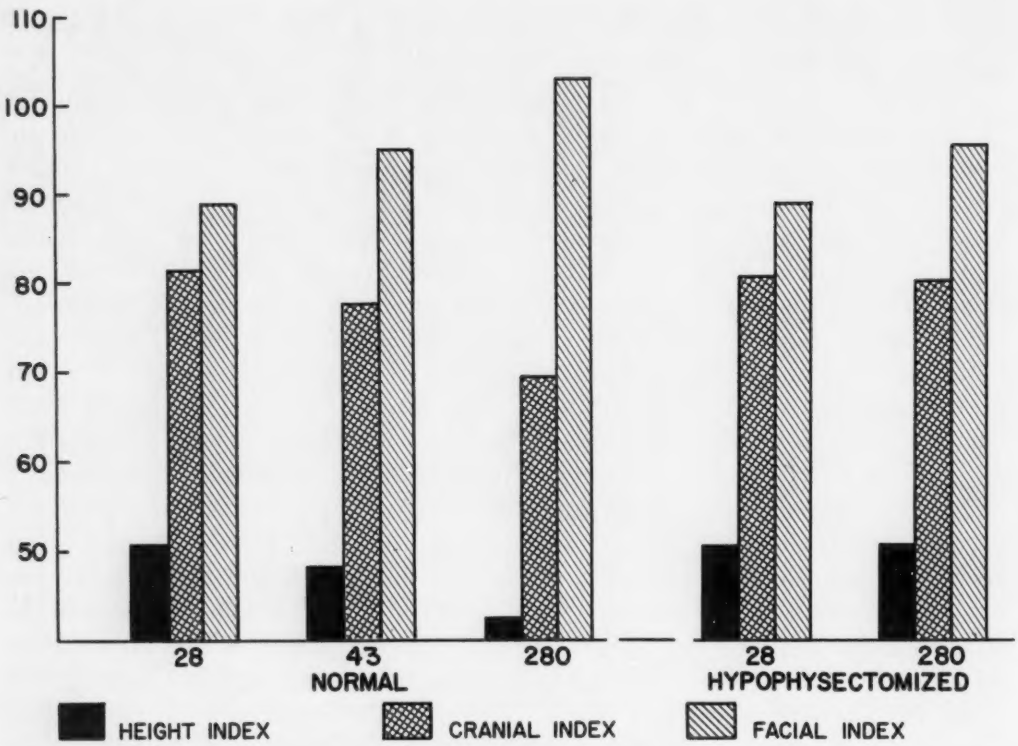

Fig. 1. Graph showing changing relations of head proportions in normal and hypophysectomized rats at the ages indicated.

$$\text{Height index} = \frac{\text{Height of neurocranium}}{\text{Length of neurocranium}} \times 100$$

$$\text{Cranial index} = \frac{\text{Width of neurocranium}}{\text{Length of neurocranium}} \times 100$$

$$\text{Facial index} = \frac{\text{Length of facial skeleton}}{\text{Length of neurocranium}} \times 100$$

MECHANICAL PROPERTIES*

The early scientific expression of studies on bone mechanics is found in the paper by Koch[23] on "The Laws of Bone Architecture," in which it was demonstrated that the trabecular pattern in the spongiosa of the proximal end of the femur is not an accidental distribution but conforms with precision to the distribution of the compressive, tensile, and shear forces exerted thereon in weight-bearing and locomotion. Flaws have been found in some aspects of the analysis; the direction of the loading forces assumed by Koch does not correspond exactly with the thrusts exerted when the femur is in its actual position in natural posture. However, the essentials of the analytic procedure carry over well into other bones. For example, the sequence of ankle bones forms a functional weight-bearing and mobile unit, and the force patterns exerted thereon pass across joints from bone to bone. The trabecular disposition in each bone follows accurately that bone's participation in the entire force system.

*This section extends the brief remarks on this topic made during the platform presentation.

A recent adaptation of engineering testing procedures is reminiscent of the Koch studies. Models of whole bones are constructed in plastic and then examined under polarized light. Unstressed models show uniform illumination, but when forces are applied alternating bands of light and shadow appear which may be photographed and analyzed geometrically. These patterns can be "frozen" into the model by heating, and subsequent sectioning after cooling allows internal stress to be studied. The method is useful in that it has allowed some over-all patterns to be mapped out. It is, of course, subject to the criticism that the model is composed of essentially homogeneous material and is therefore of somewhat limited usefulness in providing an analogy for bone mechanics.

Tappen[30] has used the Benninghof split-line technique for analysis of cortical bone, especially in the skull. The procedure consists of decalcifying the bone and then making multiple tiny punctures with a sharp needle. Fissures develop from the punctures; these are filled with India ink, and a pattern thus emerges of the disposition and orientation of bony lamellae in the area. The series of studies has been instructive in showing how the powerful forces exerted during mastication may be redistributed along the various buttresses of the upper jaw and thus dissipated in bony regions remote from the immediate neighborhood of dental attachments. Studies of such primates as the gorilla, in which the crushing forces are extreme, have extended the earlier work on the human face.

Bell and colleagues[7-10] in Glasgow used intact bones, such as the femur, from experimental animals in a series of studies dealing with dietary calcium variation, vitamin D supply, and a number of endocrine circumstances. Specimens were subjected to standardized loading in both bending and twisting tests. The results have served to correct many impressions or traditions not based on controlled experiments. Except in extreme cases, low-calcium diets did not alter breaking stress. Breaking stress was directly correlated with ash content of the bone, especially in bending tests. The difficulties in accurately measuring twisting led to a less effective correlation. Administration of anterior pituitary growth-promoting extracts, or of estradiol, parathormone, or thyroxin, did not primarily alter the mechanical properties of the bone. Although the breaking stress of bone was reportedly equal to that of cast iron, Young's modulus of elasticity (a measure of recovery from acute deformation of the specimen) was about ten times that of cast iron. In general, it could be shown that, except as the various experimental situations altered ash-organic ratios, they did not account for the production of bone deformities.

One of the most comprehensive programs is that of Gaynor Evans and associates.[14-15] This group has applied a number of engineering principles and strength-testing devices to the analysis of bone mechanics. Clarity of interpretation of results thus gained is increased by accurate use of the terminology of mechanics. For example, "force" is a push or pull, but "energy" is capacity for work, a more easily measured function. Forces may be "tensile" (tending to pull the object apart), "compressive" (tending to push it together), and "shearing" (tending to make one part slide or glide with respect to another part of the same specimen). In particular, "stress" and "strain" are to be differentiated. Strain is a change in linear dimensions when an outside force

is applied to a specimen; stress is the intermolecular resistance of the specimen to the deforming force. As an example, strain is the tendency for leg bones to shorten in weight-bearing, but stress is the resistance within the bones to this shortening tendency. Strain may sometimes be seen; stress must be computed from observational data.

At least three types of procedure have been used in the Evans program. The use of Stresscoat (a brittle lacquer which is sprayed on the specimen surface and which undergoes cracking when the specimen is stressed) has allowed localization of stresses in such bones as skull, mandible, femur, and tibia. Correlation with fracture sites and types is sufficiently good that the Stresscoat crack pattern can be used to predict the fractures resulting from bone failure.

Living bones have been studied by the implantation or attachment of electric strain gauges on the bone. These tiny devices can measure small and highly restricted alterations; their output, when fed into a cathode ray oscilloscope, provides a record of the strain or deformation.

The evidence that bones vary among themselves, and within a bone from region to region, has led to the development of procedures for testing small fragments of bone. Bars of standardized dimension, 3 by 0.2 by 0.08 inch, are machined from the bone itself and used as specimens in the various engineering testing devices which can apply compression, tension, torque, or shearing forces. A very large body of information has accumulated from this program, of which only a few examples can be cited. When, for example, the parietal bone is compared with long bones, it is found that its tensile strength is less than that of the cortex of long bones. The compressive strength, however, equals that of cortical bone. The differential (that is, the range between tensile and compressive strength) is much greater in the parietal bone than in long bones. Diploic bone is much like spongiosa of long bones in its mechanical properties. In other studies, the fatigue strength of the specimen has been studied. A constriction is made in the bar of bone, which is mounted in a holder so that bending can be induced under forces of 5,000 pounds per square inch. Under such circumstances, normal bones survive approximately 2 million repetitions before fatigue results in breaking. However, there are differentials between femur, tibia, and fibula; moreover, the tibia shows variations along its length and around its quadrants. An interesting observation is that previous immobilization of bone (during treatment of a patient from which an amputation specimen was obtained) cuts the fatigue life to one-fourth normal.

As intimated earlier, lack of homogeneity introduces difficulty into these analyses. Bone is heterogeneous in structure, from the gross level all the way down to the electron microscope level, and corrections must be devised for this heterogeneity before final conclusions are drawn from the engineering testing procedures. Evans reports that caliper measurements of the dimensions of the specimen are inadequate bases for the determination of strength. Photomicrographic reconstruction of the histologic structure at the test site is necessary to determine the amount of bony material present. Under these conditions, it is found that the strength of bone is affected by the dimensions of its

Haversian systems; it is stronger when composed of fewer, larger osteones than of many small ones. The more abundant the cement lines per unit area, the less is the strength. The measured strength increases when the loading is applied in a direction parallel to that of the majority of the collagen fibers.

Another interesting and timely study has been made at the University of Utah in connection with the investigation of biologic problems associated with bone-seeking radioactive substances, such as strontium-90 and radium. Hollingshaus and Mays[19] studied the reduction of bone strength resulting from radium intoxication in dogs. It is well known that "hot spots" and diffuse localization may result in devitalization of bone; dimensions of the damage may go from submicroscopic to areas of several millimeters. It was possible to show a loss of strength of such bone. However, as in the work of the Evans group, it appears that microscopic analysis of the specimen is necessary to correlate the loss of strength of such bone precisely with the distribution of its devitalized areas.

In a long-range program, Dempster[12] has adapted a standard strength-testing procedure for irregular-shaped objects to the analysis of bones. It is called the "method of sections." To date the mandible, humerus, and clavicle have been analyzed, with a brief note published on the last. In this technique, the entire bone is embedded in a standardized position in an investing mass such as plastic wood. Very thin serial sections are cut at right angles to the longest axis. The bony contours, including even delicate portions of spongiosa, are accurately transferred to cardboard and a cutout of the section is then made. Each section is analyzed by determining area moments of inertia (a gravity method) for the major and minor axes about which the mass of the model is distributed. These axes are then plotted, by three-dimensional graphic methods, for each section, and mathematical expressions are obtained which express regions of strength and weakness. These may be correlated with the known actions of the bone and the muscular and ligamentous attachments. The method is time-consuming and requires patient attention to detail; it does not lend itself easily to analysis of large numbers of specimens, but it yields information of critical value.

CONCLUSION

It has long been customary to emphasize the dynamic capacities and lability of the osseous system. The many active programs in laboratories and clinics which seek the understanding of skeletal dynamics are providing a basis for their full incorporation in clinical practice, to the end that the informed practitioner may turn them to advantage in attaining therapeutic objectives.

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Diagnosis and treatment planning of cases presenting problems due to missing teeth

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THE MAJORITY of malocclusions in an orthodontist's practice can be treated by following certain basic rules and methods of procedure. It is the occasional unusual case which is troublesome. This article will deal with the problem of missing teeth—a problem which is frequently faced by every orthodontist. In his *Text-Book of Orthodontia,* Strang[1] states: "With apparently increasing frequency each year, the orthodontist is called upon to treat cases in which teeth are congenitally missing. But happily, with lessening frequency is he confronted with patients in whom permanent teeth have been extracted, either because of extensive caries or from a desire on the part of the dentist to relieve the crowded conditions in the dental arch . . . consequently, most of the 'problems of missing teeth' center around the congenitally absent dental units."

Since several of these cases with missing teeth are found in most orthodontic practices, the experiences and findings of men who have treated similar cases are beneficial. Unfortunately, because of the great variances found in this problem, there is no set pattern of treatment to follow. Therefore, each orthodontist must weigh the information available and then rely on his own judgment. Dewel[2] states: "Success or failure depends on a recognition of the limitations, as well as the possibilities of orthodontics . . . ." Ideal treatment is difficult, if not impossible, when dental units are missing. Therefore, the diagnosis and treatment of these cases are matters of compromise.

The purpose of this article is to discuss the diagnosis and treatment problems of cases in which teeth are congenitally missing, cases in which teeth were extracted prior to orthodontic examination, and cases in which there are malformed

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dental units. These cases can be treated by (1) opening space that should be occupied by the missing teeth and replacing the missing teeth with artificial dental units or (2) closing the spaces and thus eliminating the need for artificial substitutions.

I recognize that there are innumerable variations and possible combinations of missing and extracted teeth. I cannot hope to cover all these possibilities, but I shall attempt to review a few of the most common types.

In those cases in which teeth are congenitally missing or have been extracted prior to orthodontic consultation, I believe that closing of the spaces by orthodontic means should be the method of choice. One must realize that in certain cases in which dental units are undersized or in an unfavorable position, this generalized statement does not apply. Space closure is made difficult by (1) an excessive amount of space to be closed or (2) an uprightness of the teeth next to the space to be closed. When many teeth are missing, making complete space closure ill-advised, then an attempt should be made to collect and arrange the spaces within the arch so that the best possible bridgework may be placed.

Strang[1] writes that the teeth which are most frequently congenitally missing are the maxillary lateral incisors, followed in order by the mandibular second premolars, the maxillary second premolars, the first premolars, and the mandibular lateral incisors. In contrast, Valinoti[3] states: "Most frequently absent, exclusive of the third molars, are the second premolars, especially in the mandibular arch." Teeth which are infrequently missing are the central incisors, the cuspids, and the molars.

In cases which require space opening or closing and en masse movement of posterior teeth, one must use an appliance which is capable of opening or closing spaces efficiently, which resists tipping of the teeth adjacent to the spaces, and which has control over all the teeth. This necessitates a full-banded appliance. If the crowns of the teeth adjacent to the spaces are tipped together during treatment, these teeth will have a tendency to upright. This will result in improper interdigitation and a partial return of the spaces. If the roots of these teeth are paralleled in treatment, the return of space between these teeth is improbable. The cases described here were treated with the edgewise appliance.

In cases with missing teeth the usual diagnostic aids are used in diagnosis and treatment planning; these aids include record models, intraoral roentgenograms, cephalometric roentgenograms, and photographs. In these cases the cephalometric x-ray is very helpful for determining diagnosis and treatment procedures. For example, if the mandibular second premolars are congenitally missing and it is found that mandibular incisors are well forward in a protrusive position, this would indicate that some of the space closure in the mandibular arch could be accomplished by uprighting these teeth; conversely, if the mandibular incisors are upright over basal bone, then one would recognize that in order to close space in the mandibular arch, it will be necessary to move the mandibular posterior teeth mesially.

The setup, as described by Kesling,[4] is a key adjunct in formulating a plan of treatment in these cases. By using the setup, one may predetermine, in making the diagnosis, whether or not complete closure of the spaces can be accomplished

and also how the posterior teeth will interdigitate in the attainment of the best functional occlusion. When making the setup, we should strive to keep symmetry of teeth within the arch wherever possible. This does not always hold true, however, because of tooth size discrepancies in the maxillary and mandibular teeth.

Another very important diagnostic aid is the study made by Bolton[5] which determines whether tooth size discrepancies exist between the maxillary and mandibular teeth. In this study, ratios of the size of maxillary and mandibular teeth were determined; if these figures do not correlate, then a discrepancy exists. This analysis will help to determine which teeth can be missing from the maxillary or mandibular arches without interfering with proper interdigitation. These findings may be substantiated by means of the diagnostic setup. When the maxillary lateral incisors are congenitally missing, an anterior ratio would be determined by including the maxillary first premolar measurements.

MISSING ANTERIOR TEETH

MISSING MAXILLARY LATERAL INCISORS. When the maxillary lateral incisor is missing, the orthodontist should review several considerations in arriving at a treatment plan.

The position of the maxillary cuspids is of paramount importance. If these teeth have erupted mesially into the approximate position of the lateral incisors, then one would consider closing the space in the maxillary arch. If, because of the retention of deciduous lateral incisors, they have erupted into their normal position, then opening of the space would be considered.

Should the absence of the permanent lateral incisors be discovered early, a Bolton ratio may be determined from the intraoral roentgenograms. If this study shows that the tooth pattern is harmonious and space closure is the treatment of choice, then it is wise to extract the maxillary deciduous lateral incisors and cuspids early and allow the permanent cuspid bud to migrate mesially, thus facilitating subsequent treatment.

The shape of the maxillary cuspid crowns is also a key to diagnosis in these cases. If the maxillary cuspids have relatively short cusps, this is an indication that they could be moved into the lateral position and, with judicious grinding, be reshaped to resemble the lateral incisors, both functionally and esthetically.

Should we find the mandibular arch severely jumbled in these cases, then removal of the mandibular first premolars is indicated. If the mandibular arch is fairly well aligned and there are spaces to be closed in the maxillary lateral incisor area, the mandibular arch may be aligned and retracted if necessary, and the maxillary posterior teeth may be moved anteriorly by means of Class III elastics.

An excellent article by Carlson[6] gives detailed instructions for treatment by space closure in cases in which lateral incisors are missing.

In some cases in which the maxillary lateral incisors are missing we find that the size and shape of the teeth do not lend themselves to space closure. A case of this type would be one with maxillary central incisors which are narrow and chisel-like, with little or no bell shape to the distal portion of the crown.

The maxillary cuspids are narrow and very pointed, with the mesial incline of the cutting edge sloping high to the gingival. In this type of case the lateral space should be opened by moving the maxillary posterior teeth into Class I position. When treatment of the case is finished, a maxillary retainer should be made, with the lateral replacements, and then worn until the patient reaches an age at which permanent bridgework may be placed. In view of the fact that the maxillary retainer will be worn over a prolonged period, the orthodontist and the patient must be acutely aware of the danger of caries to the lingual surfaces of the teeth. If gingival etchings become a problem, temporary bridges may be made to replace the missing lateral incisors.

Orthodontic treatment in the case shown in Figs. 1 and 2 was accomplished by closing maxillary lateral incisor spaces and extracting the mandibular first premolars. This patient's maxillary right lateral incisor was missing, and the maxillary midline had shifted to the right. In the mandibular arch we find jumbling and gross lack of space. The treatment plan in this case was to extract the maxillary left lateral incisor and the mandibular right and left first premolars. The mandibular arch was treated routinely; the maxillary central incisors were retracted to normal position, and the maxillary posterior teeth were moved anteriorly to close the remaining space. This patient had maxillary cuspids which could be ground incisally to simulate the lateral incisors. It should be noted here that when the cuspids are moved into the lateral position, it is necessary to grind the lingual surface of the cuspids so that they may be tucked into position. If this is not done, these teeth will be too prominent and prematurities may exist on the mandibular incisors.

A second type of case is one in which the maxillary lateral incisors are congenitally missing but the mandibular arch is reasonably well-aligned and retraction of the mandibular incisors is desirable. The treatment of choice is to close the maxillary lateral spaces and treat the mandibular arch by nonextraction. In the treatment of such a case, the maxillary posterior teeth are moved anteriorly, and the mandibular incisors are aligned and retracted, if necessary, by means of Class III elastics. The maxillary arch wire is reduced to allow the maxillary posterior teeth to slide along the arch wire. A headcap is placed against the maxillary arch wire to prevent the maxillary central incisors from moving into protrusion. The closure of the maxillary arch space is not usually completed with the Class III elastics, and it is necessary to employ vertical spring loop arches and/or push coil springs to finish the treatment.

MISSING MANDIBULAR INCISORS. Of all the cases in which teeth are congenitally missing, the ones that I find the most troublesome are those in which one or more mandibular incisors are missing. The mandibular arch in this type of case is usually fairly well aligned if one tooth is missing. If two permanent teeth are absent, then some spacing usually occurs.

If extraction of permanent teeth is necessary and only one mandibular incisor is missing, then extraction of the other incisor in the mandibular arch and removal of the maxillary first premolars should be considered. If two mandibular incisors are missing, then removal of the maxillary first premolars will balance the tooth number in each arch. It should be stressed that it is imperative to

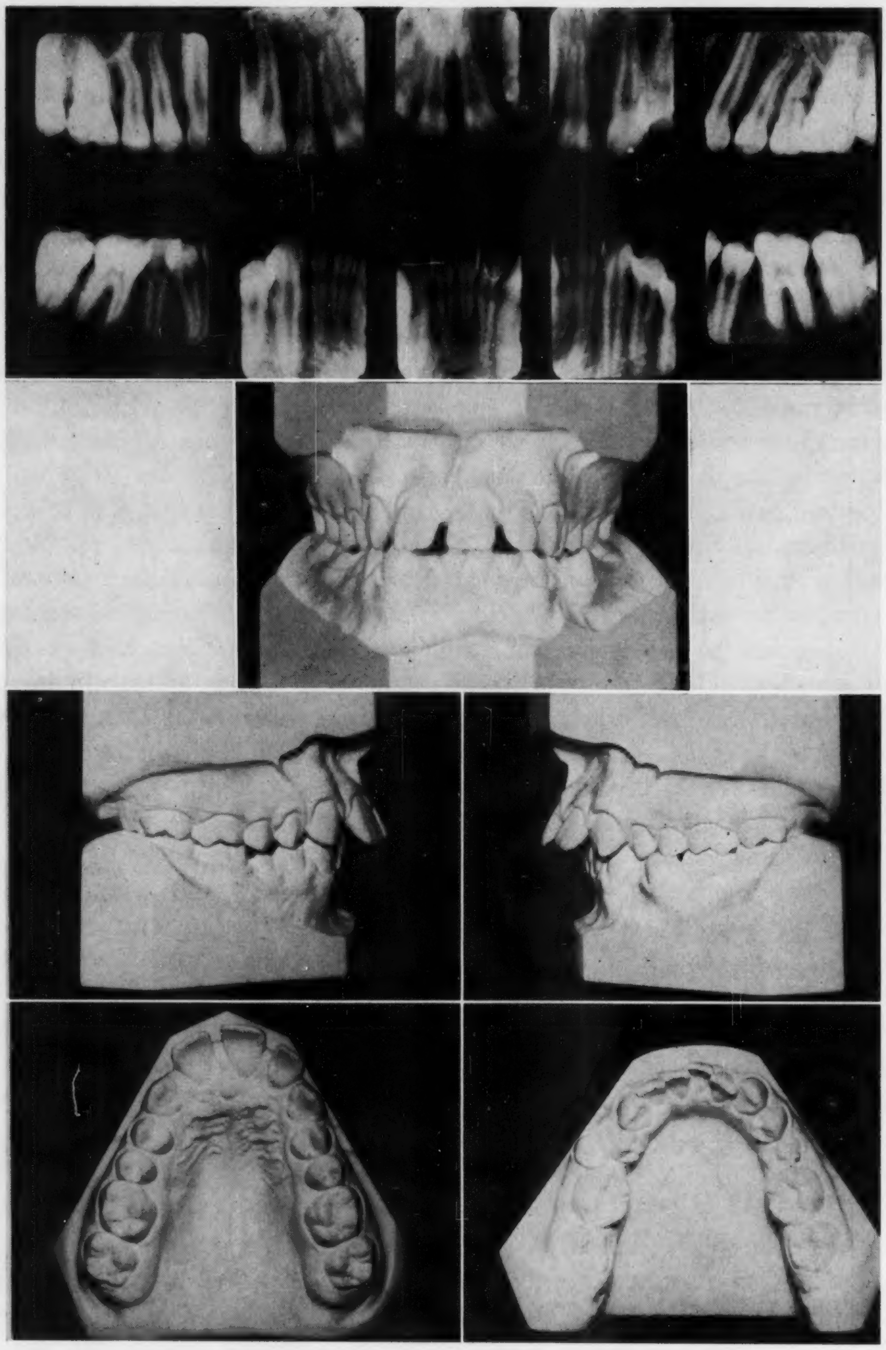

Fig. 1. Before-treatment photographs of case in which a maxillary right lateral incisor was missing.

make a careful diagnostic setup and also to use Bolton's tooth discrepancy charts to determine the ratio of the six teeth that are to be used in the anterior segments. In some cases very satisfactory results may be obtained by the "two

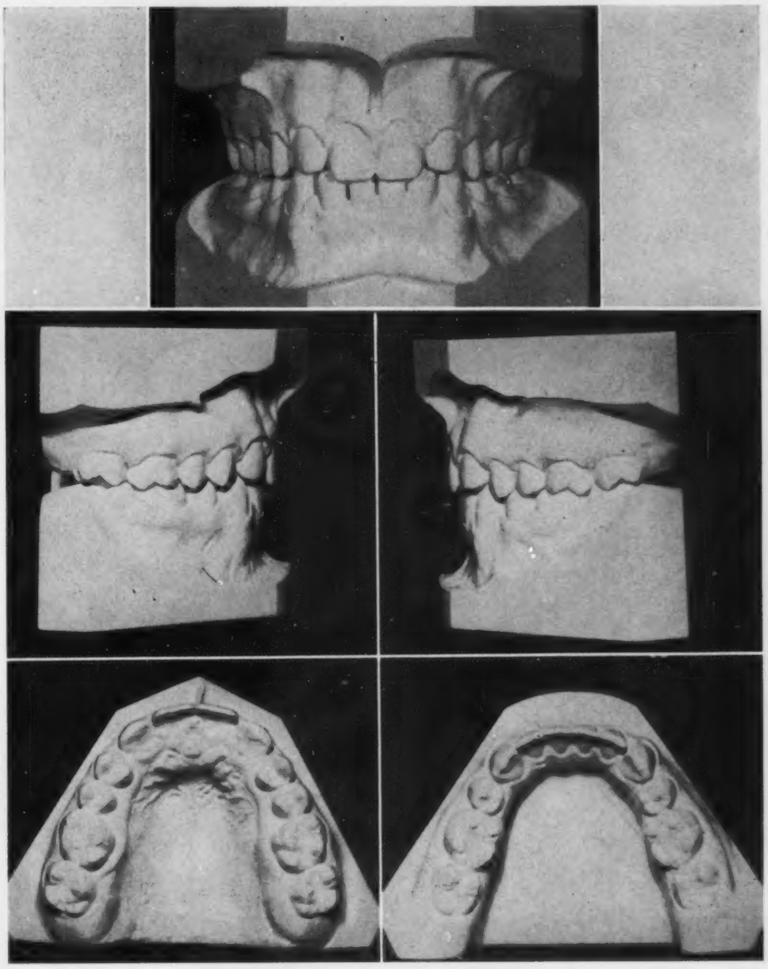

Fig. 2. After-treatment photographs of case shown in Fig. 1.

mandibular incisors–two maxillary premolars'' approach to treatment. In other cases this approach will not give a satisfactory occlusion because of variance in tooth size in maxillary and mandibular arches.

Another problem is the case in which one or more of the mandibular incisors are missing but which, under normal treatment procedure, would be a nonextraction case. If one mandibular incisor is missing, the orthodontist may treat the case with three remaining incisors, realizing that when treatment is finished there will be more than a normal amount of overjet because of the missing tooth substance in the mandibular arch. This certainly is not ideal, but it seems to be the lesser of several undesirable possibilities.

Figs. 3 and 4 show a Class I malocclusion case in which the mandibular right central incisor is congenitally missing. The mandibular arch is slightly jumbled in the lateral area, and the maxillary incisors are protrusive. When a diagnostic setup of the case was made, it was found that the protrusion could be reduced and proper interdigitation acquired by extracting the mandibular

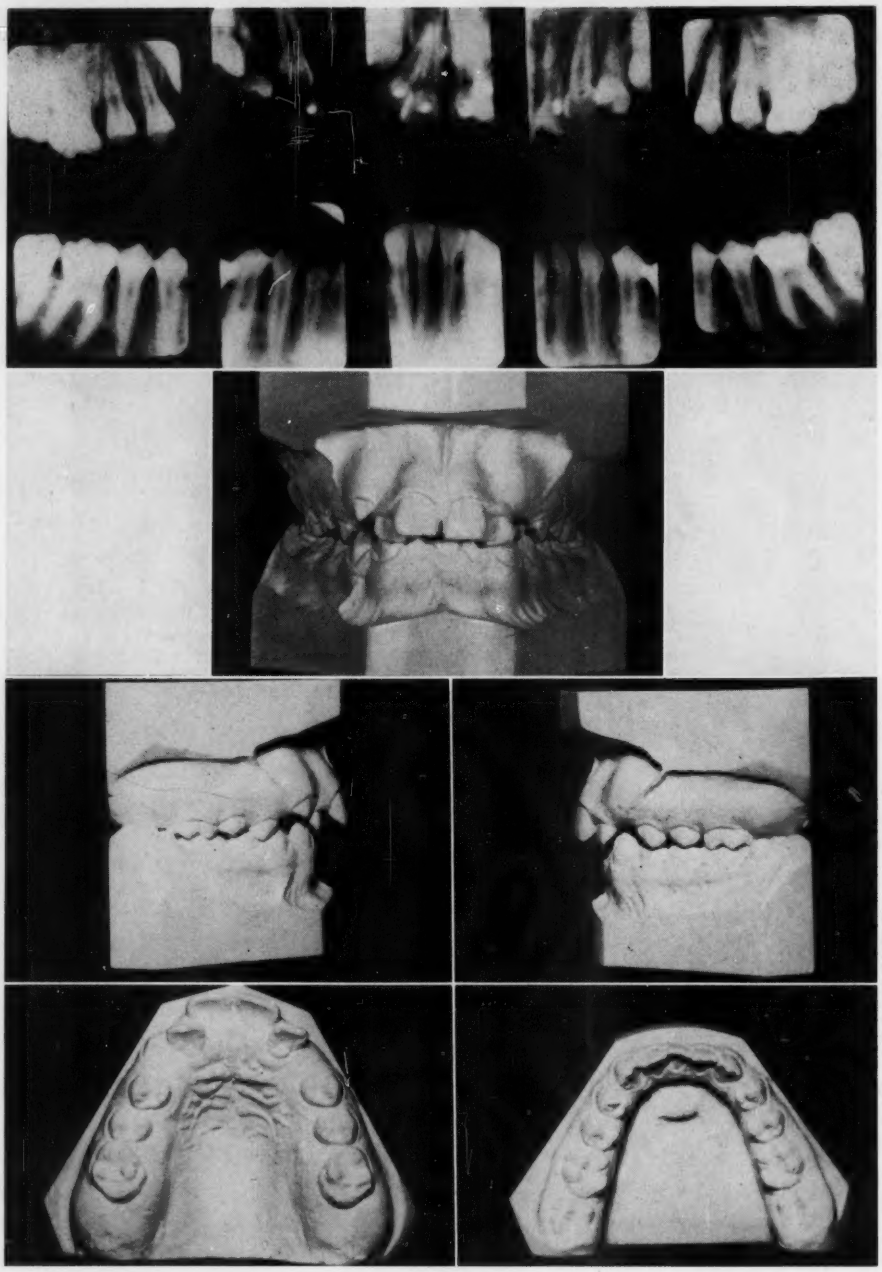

Fig. 3. Before-treatment photographs of case in which a mandibular incisor was congenitally absent.

left central incisor and the maxillary right and left first premolars. The over-all approach to treatment was to reduce the maxillary protrusion and close space in the mandibular arch by using the reciprocal forces of Class II elastics. Such force moves the mandibular cuspids into the spaces normally occupied by the mandibular lateral incisors. By judicious grinding, the cuspids are flattened

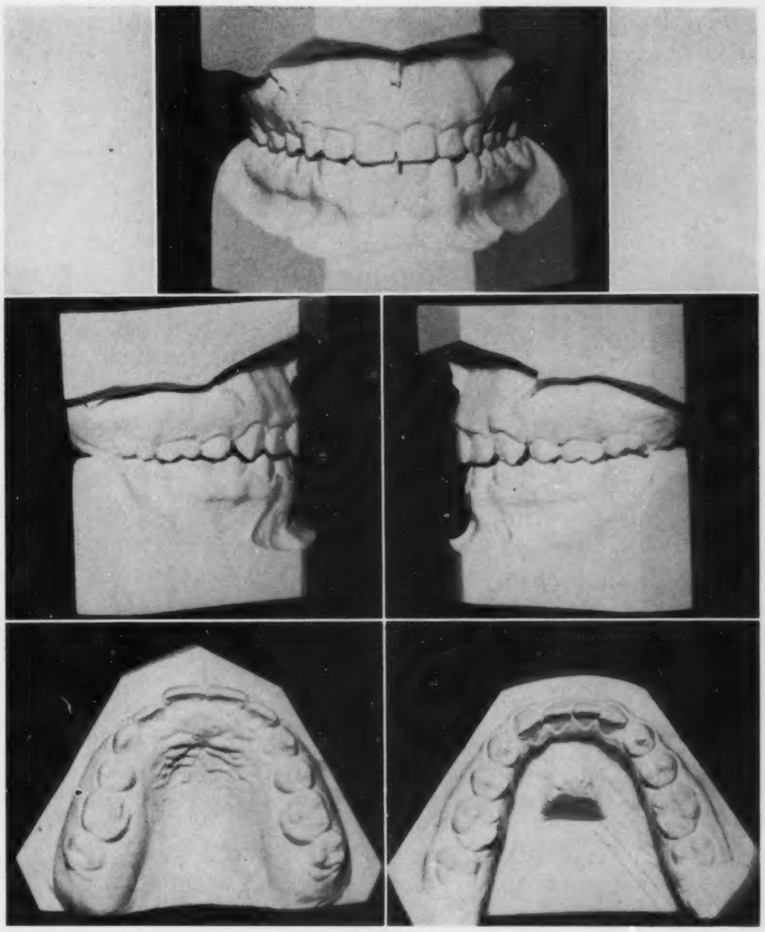

Fig. 4. After-treatment photographs of case shown in Fig. 3.

to form an incisal cutting edge to simulate the lateral incisors. The labial surface of the cuspid may require spot grinding to allow the maxillary lateral incisors to be moved into position.

MISSING POSTERIOR TEETH

MISSING SECOND PREMOLARS. The mandibular second premolars are usually considered the second most frequently congenitally missing teeth, followed by the maxillary second premolars. In most of these cases closure of the space is desirable, but there are certain pitfalls. As Strang[1] states, "The factor of greatest influence in such a case is the extent of the overbite. When the examination shows an abnormal degree of overlapping of the incisor teeth (bite closure) . . . it would be a serious mistake to attempt to move the mandibular molars mesially . . . the tendency would be to increase the extent of the overbite."

Another problem to be considered in space closure of the mandibular second premolar areas is the discrepancy in the height of the mesial marginal ridge of

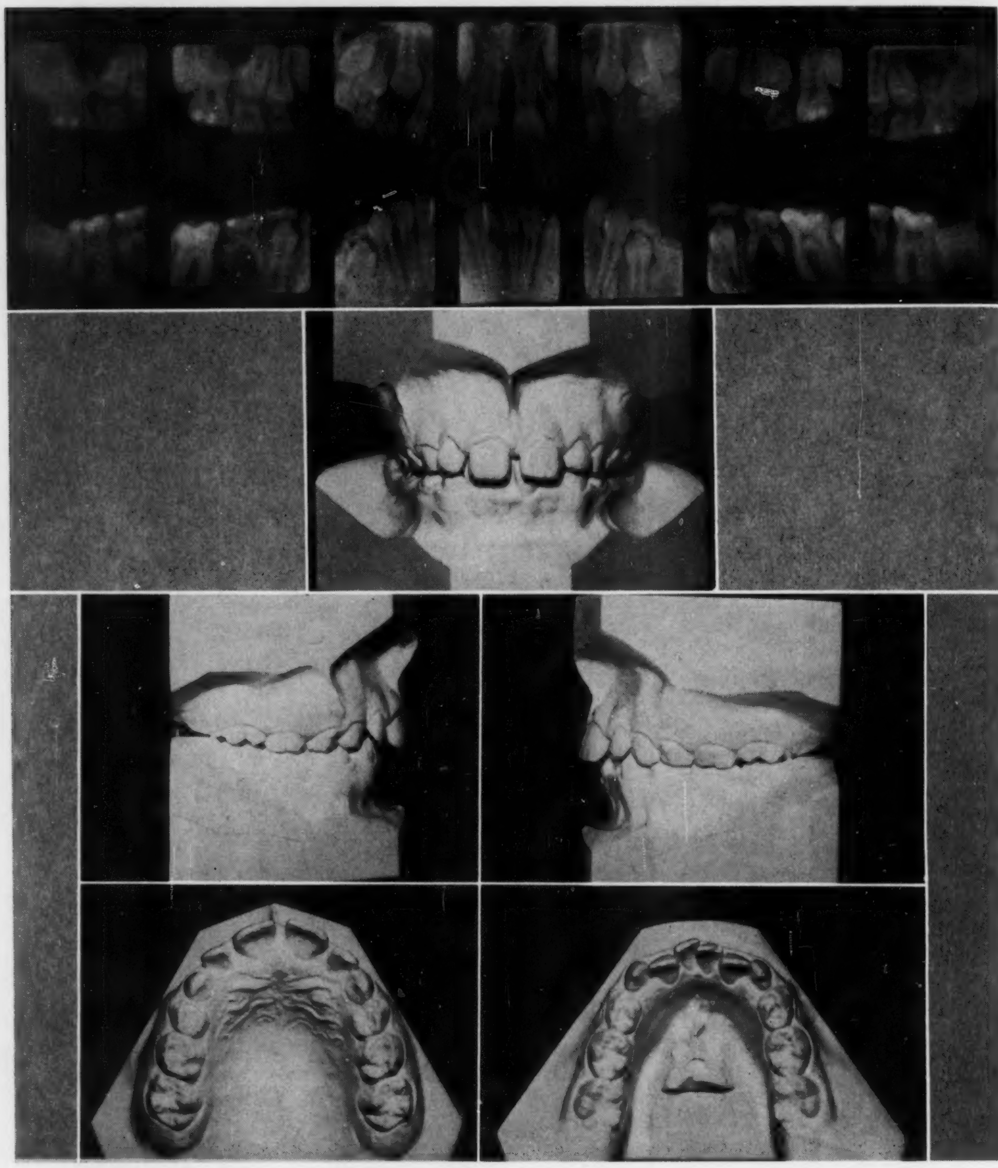

Fig. 5. Before-treatment photographs of case in which mandibular second premolars were congenitally missing.

the mandibular first molars and the distal marginal ridge of the mandibular first premolars. It is sometimes difficult to keep these teeth in contact, and food impaction may result. However, if examination reveals that there is no excessive close-bite, that the mandibular first premolars have good distal marginal ridge height, and that there is no excessive spacing in the rest of the arch, then I believe that closure of the space is the proper treatment plan.

In the case shown in Figs. 5 and 6, examination revealed that the mandibular second premolars were missing and that there was a normal complement of teeth in the maxillary arch. Under usual conditions extraction of the maxillary and mandibular first premolars would have been required, but under the

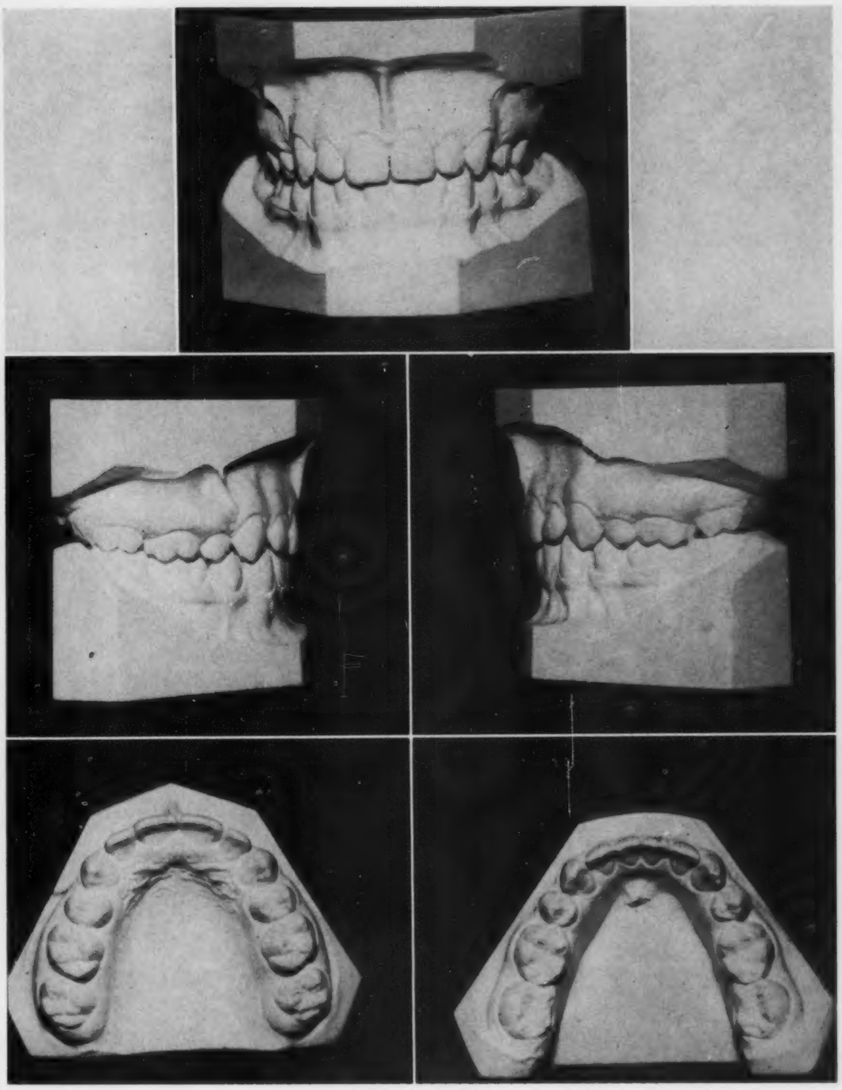

Fig. 6. After-treatment photographs of case shown in Fig. 5.

existing circumstances the maxillary first premolars and the mandibular second deciduous molars were extracted and the case was treated routinely. Such a case may be somewhat more difficult to treat than the usual case involving first-premolar extraction, because of the necessity of moving both the mandibular first premolars and the cuspids distally into these spaces. If the case is of a borderline nature where extraction is concerned, one might remove the maxillary second premolars and the mandibular second deciduous molars and treat as described by Nance[7] and Dewel.[2]

In the case in which mandibular second premolars are congenitally missing, if there is an excessive overbite or if the mandibular arch has a great deal of spacing because of inadequate tooth size, then the retention of second deciduous molars and eventual replacement with fixed bridgework should be considered.

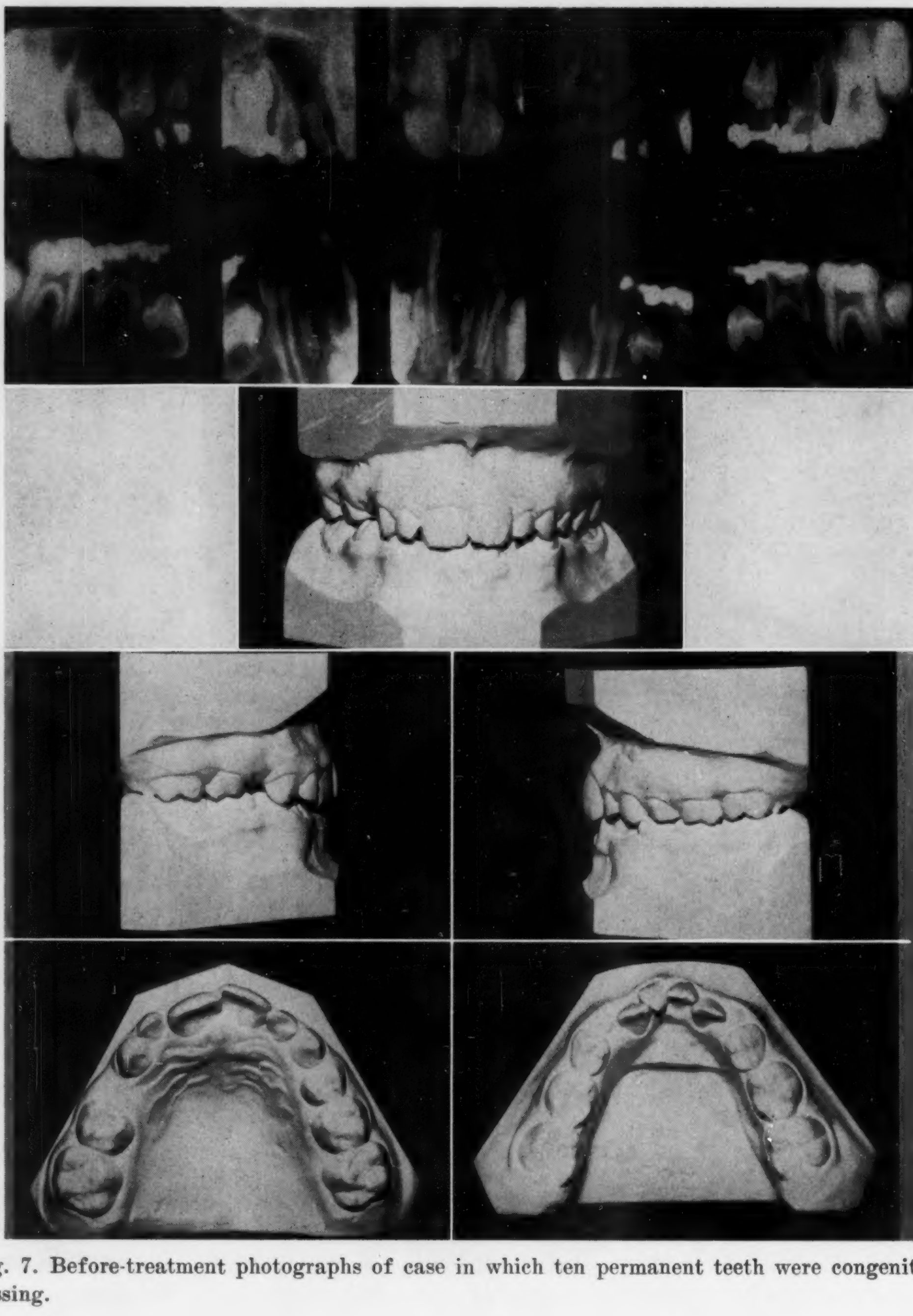

Fig. 7. Before-treatment photographs of case in which ten permanent teeth were congenitally missing.

If second deciduous molars are retained, the mesiodistal width of these teeth should be reduced to allow proper interdigitation of the posterior teeth.

MULTIPLE MISSING TEETH

In every orthodontist's career there is seen the occasional case in which several teeth are congenitally missing in both the anterior and posterior areas

of the dentition. In these cases, space should be closed wherever possible, and if space closure is not feasible then the teeth should be arranged to receive the best in functional bridgework. It is sometimes possible to retain some of the

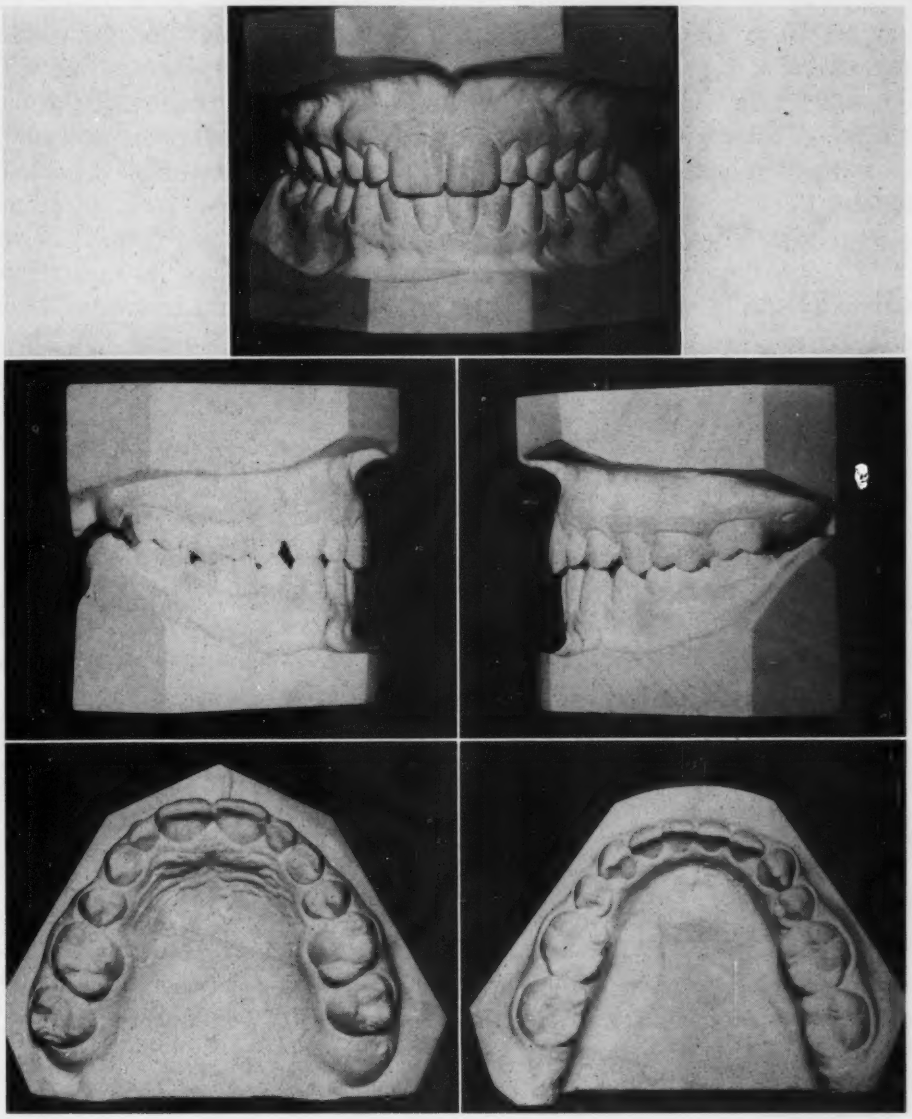

Fig. 8. After-treatment photographs of case shown in Fig. 7.

deciduous teeth, and it is surprising to find that these teeth may not be exfoliated for many years. Case histories of these patients often show a hereditary pattern of multiple congenitally missing teeth.

Figs. 7 and 8 show a case in which ten teeth are congenitally missing. The missing teeth are the maxillary right and left lateral incisors, cuspids, and second premolars, and the mandibular right and left second premolars and third molars. It is obvious that we were fortunate in having symmetry within each

arch of the missing teeth. The treatment plan in this case was to extract the mandibular second deciduous molars. The mandibular cuspids and first premolars were retracted sufficiently to allow proper alignment of incisors, and the spaces between the mandibular first premolars and first molars were closed. In the maxillary arch it was decided to collect the existing space by extraction of the second deciduous molars. The first premolars were then moved distally into contact with the first molars. When treatment was completed, the patient had a mandibular arch in which no artificial replacements were necessary. In the maxillary arch there are two areas without permanent teeth—the maxillary right and left lateral incisors and cuspids. The bands were removed from this case approximately five years ago, and the patient still has retained the maxillary deciduous lateral incisors and cuspids. These teeth are not esthetically or functionally ideal, but until permanent artificial units can be placed they are satisfactory.

CONCLUSIONS

1. Cases in which teeth are congenitally missing are frequently encountered by the orthodontist.

2. Careful diagnosis and treatment planning are imperative in these cases.

3. If possible, the space created by congenitally missing teeth should be closed. If this is not possible, the spaces should be collected and so arranged to permit restoration by the best functional bridgework.

4. In planning treatment of this type of malocclusion, one should strive to create or maintain symmetry of teeth within each arch.

5. Judicious spot grinding may be necessary on the teeth which are moved into positions other than their normal location.

6. There are exceptions because of the size, shape, or position of the teeth adjacent to the spaces.

SUMMARY

If, by the closure or arrangement of these spaces, we can give the patient a dentition which requires limited or no fixed bridgework and if we can achieve pleasing esthetics and a sound functional occlusion, it would seem that we have fulfilled our obligation orthodontically.

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Malocclusion in different ethnic groups living in Israel

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INTRODUCTION

LIKE DENTAL CARIES and periodontal disease, malocclusion is today a public health problem of major importance. Recent investigations have established its bearing upon the health of the oral structures and their proper function in mastication and speech. In addition, modern society, with its growing awareness of the importance of appearance, recognizes malocclusion as a condition which may interfere with the right of the individual to achieve maximum usefulness and happiness.[1] The present study is the third part of an extensive survey of the prevalence of oral disease in school children in Israel carried our in 1957 by the Ministry of Health. Data on caries and fluorosis[11] as well as on gingivitis[12] are being published elsewhere.

MATERIAL

This study is based on the examination findings in 4,500 children, aged 13 to 14 years. The children were classified according to the countries in which their fathers were born, as follows:

1. Near East—Jews from Syria, Lebanon, and Egypt
2. North Africa—Jews from Libya, Algiers, Tunis and Morocco
3. Europe—persons from all European countries and North and South America
4. Iraq and Iran
5. Yemen and Aden
6. Arabs—local non-Jewish ethnic minorities
7. Israel—children whose fathers were born in Israel

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Similar ethnic and cultural patterns were prerequisite for inclusion in a particular group. The data were further analyzed with respect to sex, type of settlement, and length of sojourn in Israel, children having come to Israel after 1948 being designated "immigrants" and the rest designated "old established." The design of the sample, some anthropologic background material, and the statistical methods applied have been reported in connection with a study of dental caries in these groups.[11]

METHODS

At present there is no satisfactory epidemiologic index for malocclusion.[10] The index suggested by Massler and Frankel[7] does not differentiate among different types of malocclusion. Simon's classification,[13] based on the orientation of the jaws in relation to three planes in space, and Kantorowicz' etiological system[5] require impressions and models. Other investigators have been concerned with therapeutic rather than epidemiologic aspects[9]; therefore, their methods are highly dependent upon the examiner's judgment and are not reproducible.

It is recognized that Angle's classification of malocclusion is not a real epidemiologic index. It was used in the present investigation, however, since it is easily applied in the field without special measuring devices and gives some impression as to the extent of the prevalence of some of the more important categories of malocclusion.

According to Angle,[2] "these classes are based on the mesio-distal relations of the teeth, dental arches, and jaws, which depend primarily upon the positions mesio-distally assumed by the first permanent molars on their erupting and locking. In Class I arches are in normal mesio-distal relations. Class II lower arch distal to normal in its relation to the upper arch, Division 1 having protruding, and Division 2 retruding upper incisors. Class III—lower arch mesial to normal in its relation to upper arch."

REVIEW OF LITERATURE

Two major reports on the distribution of malocclusion in the various types of communities in Israel—including cities, smallholders' villages *(Moshavei ovdim)*, and collective settlements *(kibbutzim)*—have been published. In 1954 Bar-Josef[3] examined 2,500 children living in kibbutzim and found a high prevalence of malocclusion, especially of the type related to prolonged finger-sucking. The finding that finger-sucking was quite common among the children of these settlements was explained by the fact that children in kibbutzim although they received the best type of care, live together in children's houses and for the greater part of the day are separated from their parents. It had been suggested that, in spite of their excellent environmental conditions, these children suffer from a certain feeling of being deprived of parental love and tend to compensate by finger-sucking and other habits of self-gratification. Berendt and Brand[4] recently compared *kibbutz* and town children and also found a higher correlation between malocclusion and oral habits in *kibbutz* children.

Table I. *Prevalence of malocclusions in children 13 and 14 years of age living in Israel (Percentage of children affected)*

Origin	*No. examined*	*No malocclusion*			*Class I*		*Class II, Division 1*		*Class II, Division 2*		*Class III*	
		Total	*Before 1948*	*After 1948*	*Before 1948*	*After 1948*	*Before 1948*	*After 1948*	*Before 1948*	*After 1948*	*Before 1948*	*After 1948*
Yemen	369	61.1	39.7	67.9	22.1	17.5	33.8	8.9	4.4	5.4	0.0	0.8
Near East	156	59.6	51.2	62.1	19.5	18.7	24.4	12.8	4.9	5.9	0.0	0.5
Iraq and Iran	561	58.5	58.6	58.4	15.7	22.9	20.0	12.0	5.7	6.1	0.0	0.5
Europe	1,946	51.3	47.3	52.5	21.0	24.3	28.1	14.7	2.4	7.8	1.2	0.7
Israel	214	46.4	46.4	-	23.8	-	22.6	-	6.2	-	0.5	-
North Africa	565	45.2	37.2	45.9	37.2	34.2	18.6	13.4	9.3	4.4	0.0	2.0
Arabs	587	33.7	37.7	-	50.3	-	13.3	-	1.7	-	1.0	-
Chicago Children,* aged 14 years	553	21.5			57.17		15.37		2.53		9.4	

*From Massler and Frankel: Am. J. Orthodontics 37: 751-768, 1951.

FINDINGS

PREVALENCE OF MALOCCLUSION. When grouped according to prevalence of malocclusion of all types, the children from Yemen showed the lowest number of malocclusions, followed by those from the Near East, Iraq-Iran, Europe, Israel, North Africa, and the Arabs (Table I). Significant differences between groups are shown in Table III.

Table II. *Prevalence of dental caries, gingivitis, and malocclusion, by origin*

Caries	*Gingivitis*	*Malocclusion*	*Prevalence*
Yemen Arabs North Africa Iraq and Iran	Israel Yemen Iraq-Iran Europe Near East	Yemen Near East Iraq-Iran	Low
Europe Israel Near East	North Africa	Europe Israel North Africa	Medium
	Arabs	Arabs	High

TYPES OF MALOCCLUSION. Class I follows exactly the same pattern as all malocclusions combined: It ranges between 18.4 per cent in Yemenites through 23.8 in Israelis, to 34.0 per cent in North Africans and 50.3 per cent in Arabs. In all but the last two groups Class II was of about the same prevalence, with Division 1 taking the greater share (Table I). Class III malocclusion occurred remarkably seldom in all groups.

Table III. *Prevalence of malocclusion (Class II, Division 1) in relation to children with malocclusion only, by origin and period of residence*

Origin	*Period of Residence*		
	Before 1948	*After 1948*	*Total*
Israel	42.2	–	42.2
Iraq and Iran	48.0	28.9	29.5
Yemen	56.3	27.7	33.2
Europe	57.5	38.7	46.5
Near East	53.3	26.9	28.5
North Africa	29.6	22.2	25.2
Arabs	20.0	–	20.0

SEX DIFFERENCES. No significant differences between the sexes were found with respect to occurrence of malocclusion.

DIFFERENCES WITH REGARD TO TYPE OF SETTLEMENT. In Jews, as well as in Arabs, prevalence rates of malocclusion were not significantly different between children living in cities and those from villages, whereas in *kibbutzim* the prevalence rate was significantly higher than in children from both of the other types of settlement (Table IV).

MALOCCLUSION BY PERIOD OF RESIDENCE IN ISRAEL. As a rule, malocclusion was higher in children who were born in Israel or had immigrated before 1948 than in those who came later; this difference is especially striking in Class II, Division 1, which is considerably more prevalent in the old established population (Table III).

Table IV. *Prevalence of malocclusion (all types), by type of settlement*

Community	*Settlement*	*Children examined*	*Per cent with malocclusion*
Jews	City	2,238	48.7
Jews	Village	1,281	45.7
Jews	Kibbutz	289	75.0
Arabs	City	102	73.0
Arabs	Village	485	64.9

There are two groups of statistically different prevalence rates for caries and three for gingivitis and malocclusion (Table II). Children of the "Yemen" group show low morbidity in all three diseases, as do those of the "Iraq and Iran" group. The "Europe" and "Israel" groups are rated medium in caries and malocclusion and low in gingivitis; the "Near East" group shows a similar pattern, except that malocclusion is also low. The Arabs are a category to themselves, having a low prevalence of caries, but a high rate of gingivitis and malocclusion. The "North Africa" group constitutes the link between the Arabs and the other groups in that caries experience is low, malocclusion medium, and gingivitis significantly higher than in the other groups but not as high as in the Arab group.

A positive significant correlation for gingivitis and malocclusion was established in all Jewish groups combined ($r = 0.65$) as well as in Arabs ($r = 0.57$).

DISCUSSION

There are not many published studies on the prevalence of malocclusion with which the present investigation might be compared. Data of the Chicago survey conducted by Massler and Frankel[7] have been included in Table I for comparable age groups. The percentage of children with no malocclusion was much lower than in all the groups in Israel. Class I was by far the most important anomaly, and more than 50 per cent of the children were found to be affected, whereas Class II, Division 1 was diagnosed in about 15 per cent. These figures are similar to the corresponding rates in the Arab children; in all the Jewish groups the difference in the prevalence of the two Classes is much smaller. Another striking difference is the very low rate of Class III malocclusion, an anomaly whose hereditary character has been well established, in Israel.

Reviewing the differences in incidence of malocclusion between the various ethnic groups raises questions as to the extent of existing genetic differences and the amount of difference acquired through environmental influence. Because of the interaction of genetic and environmental factors and because of the lack

of controlled observations, it is impossible at present to establish genuine specific ethnic or racial characteristics. However, division of the children according to their period of residence in Israel shows a definite trend toward an increase in malocclusion in the old established population as compared with the immigrants (Table I). It appears that this fact is due mainly to a considerable increase in Class II, Division 1 malocclusion. The growing importance of this anomaly becomes even more evident when it is related not to the total number of children examined but to only those having malocclusion (Table III). Especially striking is the difference in this respect in the groups of low prevalence of malocclusion (Yemen, Iraq-Iran, and Near East) between newcomers (in Israel since 1948) and children who were brought up in Israel. This change without any doubt is the result of environmental factors. It has been shown that Class II, Division 1 malocclusion can be produced by pernicious habits, such as prolonged compulsive finger-sucking, nail-biting, etc. It has been shown also that such habits are established to relieve childhood stresses caused by feelings of neglect and lack of parental care.[14] Life in modern Israel tends to cause radical changes in traditional family patterns. Both parents have to work in order to provide the means for the constantly rising standard of living. The birth rate decreases, and children, instead of being cared for by their mothers or older siblings, are sent at an early age to day nurseries or to kindergarten. This change is particularly conspicuous in the communities of oriental origin.

The pattern of child rearing in the collective settlements has been described briefly. Berendt and Brand[4] have shown that both compulsive finger-sucking and other habits of the same origin (for example, enuresis) were much more frequent in kibbutz children than in urban children. They have shown also a correlation between finger-sucking and prognathism, as regards both incidence and severity. The findings of the present investigation are therefore well in accord with those of the former and seem to confirm the theory that the observed increase in the prevalence of Class II, Division 1 malocclusion may be due to the spread of oral habits which may be caused by changes in family life, imitation, or perhaps other factors which so far are unknown. It is understood that no attempt is being made to enter into the discussion of the share of oral habits among all possible causes conducive to the development of Class II, Division 1 malocclusion.

The role of malocclusion as a predisposing factor for gingivitis is acknowledged, and therefore a positive correlation between the two conditions has been reported. However, no such correlation could be established for dental caries and malocclusion. In both areas the findings of the present study are in accord with those reported by Massler and Savara[6] and Massler, Ludwick, and Schour.[8]

SUMMARY

A total of 4,500 children, 13 to 14 years of age, were examined for the prevalence of malocclusion. Two dentists who had been previously trained and found to show comparable findings performed the examinations by means of

mouth mirror and explorer. Malocclusion was classified according to Angle's system. Findings were analyzed with regard to sex, origin, time of residence in Israel, and type of settlement.

CONCLUSIONS

Malocclusion was found in different degrees in the various groups. A comparison between types of anomalies was more meaningful than data relating each anomaly to the total number of children examined. The disturbances caused by certain psychologically conditioned habits were observed more frequently in Europeans than in Orientals, in old established residents than in immigrants, and in *kibbutzim* children than in children living in cities and villages. These findings concurred with those of former investigations which had also established the connection between the development of such anomalies and various social and cultural factors characteristically influencing and changing the pattern of family life in Israel.

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EDITORIAL

Roentgenographic Cephalometric Workshop transactions now available

WHETHER one "uses" cephalometrics or not, he will find ***Roentgenographic Cephalometrics,*** the transactions of the Research Workshop conducted by the Special Committee of the American Association of Orthodontists, of great value in his everyday practice. This authoritative text, edited by J. A. Salzmann, is published by the J. B. Lippincott Company of Philadelphia, Pennsylvania. The price of the volume is $4.75.

The Workshop was sponsored and supported by the American Association of Orthodontists and aided by a grant (D-909) from the National Institutes of Dental Health, United States Public Health Service. The text presents a detailed account also of the first Workshop and brings together for the first time the efforts of forty-five of the foremost contributors to cephalometrics in both the United States and Europe.

Included in the transactions are the relative merits and changes of the different components of roentgenographic cephalometric analyses that were synthesized at the first Cephalometric Workshop, held in 1957, and other published analyses. The first Workshop considered landmarks: lines, planes, and angles with respect to skeletal, profile, and denture sections of the skull. The workability and the applicability of "norms" and standards evolved by various workers in the field of roentgenographic cephalometrics are discussed.

A discussion of equipment and technical requirements for research on human beings, animal experimentation, clinical roentgenographic cephalometrics, and adaptation of roentgenographic cephalometric studies to research in other fields of dentistry, medicine, and special education are included.

Among the subjects covered are "What information are we seeking from serial cephalometric analysis, for case analysis, for treatment planning, for growth studies, for prediction, from profile cephalograms and from posteroanterior cephalograms?"

The various methods of superimposing and measuring serial tracings for the study of growth and development and for the study of changes induced by orthodontic treatment, as well as the advantages and disadvantages of each, are discussed.

The technique requirements in serial cephalometric analysis, enlargement, positioning, correction, reliability of landmarks, tracings, exposure time, radiation hazards, etc. all are presented. The views to be taken at each periodic cephalometric examination, the methods for handling data obtained from serial cephalometric analysis for research purposes and for clinical use are indicated. Standard methods for using roentgenographic cephalometrics in research and in practice are included.

There is provided a guide to the statistic use of cephalometric data, including comments on sample size and character, discussion of statistical methods of validating landmarks or tracing procedures, and suggestions to ensure more proper statistical use of cephalometric data.

Information on radiation exposure of subjects of cephalograms, particularly those in long-term growth studies, is included. Included also are the various nonorthodontic areas of study in which the cephalometric technique has been used—research in dentistry that could take advantage of cephalometrics and research outside the field of dentistry that could profit from the use of the cephalometric technique. Ways are suggested in which the nonorthodontist may learn the cephalometric technique. Steps are provided to ensure the biologic validity of recommended landmarks and planes.

This book is of value to the practitioner of orthodontics, the research worker, and the student. The edition is limited and will be distributed on a first-come-first-served basis as long as the supply lasts. This is the first volume to be published under the auspices of the American Association of Orthodontists. Copies of the book can be purchased directly from the publisher, J. B. Lippincott Company, 5 East Washington Square, Philadelphia, Pennsylvania.

IN MEMORIAM

William P. McGovern

WILLIAM P. MCGOVERN, orthodontist of Tacoma, Washington, died suddenly on Friday, July 28, 1961, at the age of 62 years.

Dr. McGovern attended the University of Washington for two years and then entered the University of California School of Dentistry, from which he graduated in 1921. He returned to Tacoma, where he practiced until his death.

He was active in many civic, dental, and orthodontic affairs. He was a member of the American Association of Orthodontists, a diplomate of the American Board of Orthodontics, a member of the Angle Society, and a founding member of the Charles H. Tweed Foundation. He assisted in the establishing of a dental school at the University of Washington and the orthodontic department in which he was a clinical associate professor of orthodontics.

Dr. McGovern was a member of Mason Methodist Church. He was active in the work of the Y.M.C.A., for which he led several financial drives, and in other groups working in behalf of boys and young men. He was a past master of Fairweather Lodge, F. and A.M., and was a member of the Shrine.

Surviving Dr. McGovern are his wife, Helen Ruth McGovern; a son, Dr. William C. McGovern, also a Tacoma orthodontist; a daughter, Mrs. Ronald F. Robbins of Tacoma; a sister, Miss Mildred McGovern of Puyallup, Washington, and eight grandchildren.

Dr. McGovern spent a great deal of time the last few months of his life helping to plan and arrange for the recent Pacific Coast Society meeting held in Seattle shortly after his death.

He had a warm and captivating personality, and his death is a great loss to orthodontics and to his many friends everywhere.

Paul D. Lewis.

Ray Woodworth (1896-1961)

RAY WOODWORTH, prominent orthodontist of Topeka, Kansas, died in a Topeka hospital on Wednesday, Sept. 20, 1961.

Dr. Woodworth was born in Holton, Kansas, on Aug. 20, 1896. His dental education was interrupted by World War I during which he served overseas for two years as a member of the United States Marine Band. He returned to Kansas after the war and graduated in 1920 from Kansas City Western Dental College (now a department of the University of Kansas City School of Dentistry). He practiced general dentistry in Holton until 1930, when he limited his practice to orthodontics and moved to Topeka, where he practiced until he entered the hospital in December, 1960. His orthodontic training included postgraduate work at Washington University and under Dr. Oren Oliver; he also spent some time in the office of Dr. H. C. Pollock.

Ray Woodworth (1896-1961).

He was active in dental and orthodontic societies and had served as president of the Shawnee County Dental Society and the Kansas State Orthodontic Society. In addition to his professional affiliations, he was a member of the First Presbyterian Church in Topeka, the Scottish Rite, the York Rite, the Arab Shrine, the Elks Lodge, and the Rotary Club.

An excellent golfer, Dr. Woodworth twice won the golf tournament of the Southwestern Society of Orthodontists. He loved to hunt quail and pheasant in the company of good bird dogs, and he enjoyed fly fishing for trout.

Dr. Woodworth is survived by his wife, Mrs. Maudie Woodworth, and a daughter, Mrs. Lamota Rawlings of Holton, Kansas.

He will be missed by the citizens of Topeka, by his professional colleagues, and especially by his young patients, who were extremely fond of him.

DEPARTMENT OF ABSTRACTS AND REVIEWS

Edited by DR. J. A. SALZMANN, *New York City*

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

Is the Condylar Growth Center Responsive to Orthodontic Therapy? An Experimental Study in Macaca mulatta

By Louis J. Baume, D.M.D., M.S., and Hans Derichsweiler, M.D., D.M.D. Oral Surg., Oral Med. & Oral Path. **14**: *347-362, March, 1961.*

A review of the recent literature indicates that, contrary to Wolff's law and Roux's principle, epiphyseal cartilage plates remain highly unresponsive to mechanical stimuli. A controlled experiment in three rhesus monkeys, aged 44 to 50 months, was designed to assess condylar response to orthopedic stimulation. Roentgenographic, vital-staining, and histologic analyses of the temporomandibular articulations after treatment periods of two and one-half and four and one-half months, respectively, yielded the following results:

1. The condylar cartilage, with its endochondral growth apparatus, responded most actively to functional therapy. Upon treatment, the condylar head assumed a prolonged, bilobed shape as part of a growth response that tended to compensate for the induced mandibular displacement.

2. Transformations of the joint structures of the temporal bone remained at a microscopic level. Comparison with experimental results so far published suggests that this was due to the advanced age of the animals and the shortness of the experiment.

The unique properties of condylar cartilage among the endochondral growth apparatus were evaluated both from the biologic aspect and from the standpoint of its impact on orthodontic therapy.

Diagnosis of dento-maxillary disproportion

By J. M. Bouvet. Rev. stomatol. **61**: *17-25, 1960.*

Disproportion between the dimensions of the teeth and the jaws is frequent. In the past, this morphologic anomaly was often ignored. Profile teleradiography and radiography of the wrist are important in diagnosing the respective mesiodistal dimensions of the teeth and the dimensions of the facial skeleton.

When the teeth are too small in relation to the jaws, the diagnosis is easy. The authors discuss chiefly the signs of dentomaxillary disproportion when the teeth are too large in relation to the jaws.

Positive diagnosis is based upon a group of symptoms provided by clinical examination. Numerous clinical signs show a lack of room. There is frequently

abnormal resorption of the roots of the deciduous teeth, rotation of the incisors, absence of diastemas, dental eruption outside or inside the arch, closure of space due to premature loss or dental caries of the deciduous molars, and impaction of permanent molars.

The mesial shifting of the molars caused by dentomaxillary disproportion produces malocclusion. This is one of the reasons why it is impossible to rely on molar relation in classifying malocclusion.

To the foregoing symptoms should be added some measurements without acceptance of absolute values. The numerous anthropometric indexes described bear no mathematical relationship between the mesiodistal diameters of one or several teeth to the sum of the mesiodistal diameters of all the teeth of the arch.

Teleradiography of the profile presents two examinations of value: (1) measurement of the mesiodistal diameters of the tooth crowns of the premolars and comparison with the corresponding deciduous molars and (2) examination of the tooth crowns of the permanent molars still situated in the jaws.

Since Broadbent's work, we know the position and the inclination that the unerupted molars must have according to the child's age. If the molars are too high or too inclined, it is obvious that they will not have enough room in the jaw or that they are too large in relation to it.

The profile teleradiograph makes it possible to measure the germs of the permanent carines and to disclose the presence of the third molar. Intrabuccal radiographs are also useful.

The lack of room for the teeth is caused by lack of forward direction of growth of the teeth leading to the reduction of the length of the alveolar arch. This may be observed in the retroalveolar and, to a lesser degree, the endoalveolar portions of the jaws.

The diagnosis of dentomaxillary disproportion cannot be made if the facial diagram has not been defined and if the inclination of the alveolar processes has not been ascertained.

There may be disproportions between the different groups of teeth or between the various teeth of the same group. An example is the association of superior broad permanent incisors and deciduous molars of large dimension. The insufficiency of room is then at its maximum because of the presence of the larger deciduous teeth. This space can be improved, however, when the deciduous molars are replaced by the smaller premolars.

The lack of room for teeth in the dental arches may be the consequence of delay in bone growth. This can be ascertained by comparing the degree of maturation of the teeth to that of the skeleton by radiography of the wrist.

Finally, the differential diagnosis of dentomaxillary disproportion is based upon a study of the dimensions of the alveolar arch and the dental dimensions, taking into account the inclinations of the alveolar processes, measuring every tooth, and ascertaining the degree of change of the teeth in relation to the facial skeleton.

Hereditary characters provoke the harmony or disproportion of the two organs. Heredity fixes the pattern of the facial skeleton which may not permit regular tooth alignment.

The Association of Deglutition and Phonation Abnormalities in Children

By J. M. Bouvet. Rev. stomatol. **60**: *217-222, 1959.*

The clinical examination of children with dentofacial abnormalities should include a thorough investigation of the muscles of the mouth. This is essential, since growth of the alveolar processes is guided by the muscular system. It is important to include an examination of the particular characteristics of the various muscle groups at rest, an analysis of the anatomic relationships between the soft tissues and the dental arches, and a study of the relationships between the dental arches themselves while they are in rest position. To the foregoing should be added the observation of the path of closure of the mandible.

The tonus of each muscle group should then be evaluated, especially with respect to contraction strength. Finally, the investigation should include a careful examination of the various functions in which the muscles of the mouth play a part. Among these functions, there are two which merit special consideration —deglutition and phonation.

Among the various elements involved in the process of phonation, only the movements connected with the articulation of sounds (that is, those which call into play the muscles of the tongue and lips) fall within our province.

It is necessary to study the articulation of consonants even more than of vowels, particularly the palatal and sibilant consonants. It is far more essential to define the relationships between the tongue and the dental arches during phonation than to define the different qualities of the sounds emitted. For this reason, particular attention should be given to minor articulation disorders which are not audible but only visible, since their etiology is of considerable importance.

The association of abnormalities in deglutition and phonetic disorders accompanied by malpositions of the teeth is recognized. Research projects in this field by English investigators, particularly Rix and Ballard, and in France by Cauhépé and associates, as well as the thesis of J. C. Netter (Paris, 1955), are devoted to these problems.

As a result of the systematic examination of muscles, the author recognized the similarity of the contact areas of the tongue in abnormalities involving the first stage of deglutition and those in which the palatal consonants are defectively articulated.

When a child presents a deglutition pattern in which the teeth are kept apart, accompanied by the thrusting-out of the tongue, he will also show the same thrusting of the tongue when he articulates the consonants "D," "T," and "N."

If the tongue is not thrust forward between the arches, but is simply pressed against the palatal surface of the maxillary incisors, this same position will be noted when the patient swallows saliva and pronounces the palatal consonants.

The same is true also if the tongue presses against the sides of the dental arches. With very few exceptions, the author has always noted this similarity in the contact areas of the tongue in these two functions, so much so that he has been able in the case of children in whom it was very difficult to examine the mode of deglutition, to benefit by the observation of the articulation to give a

more accurate definition of the position of the tongue when saliva was being swallowed.

In addition, it was nearly always possible in such cases to show a diminution of the muscular strength of the tongue during elevation movements with the aid of the tests adapted by J. C. Netter for the examination of the face. This includes the abnormality in the mode of deglutition, the articulation disorder, and the diminution of the muscular strength of the tongue in the elevation movements.

These conditions are so frequent that it is possible to group these abnormalities of the muscles together, for their common feature seems to be an inability to move the tip and sides of the tongue up to the palatal arch when the different functions are being performed.

None of the muscles of the tongue has an action which is limited to that of elevation. This complex movement can therefore be accomplished only through a synergism of the various bundles of muscle fibers. This synergism is bound to call for a certain degree of neuromotor maturation.

The very rare exceptions encountered are not surprising, for we know that the nerve centers which control deglutition and articulation are distinctly separate. These exceptions once again show the need to make a complete individual investigation of the muscles in each case.

The consequences of this similarity between the contact areas of the tongue during deglutition and articulation are important, for they should enable one to complete the prescription for treatment. Since 1954, exercises prompted by J. Cauhépé for training in deglutition and articulation have become common in France in the course of orthodontic treatment. Thus, it is practically always essential to provide deglutition and articulation training at the same time.

If this almost general rule were not observed, the effects of treatment would be limited. For this reason, certain treatment courses consisting solely of education in the mode of deglutition or of articulation have been only partially successful. In these cases, it has often been possible to supply clinical proof of the need to associate the methods for educating the patients in the functions of both speech and swallowing. The indications and contra-indications for neuromotor education treatment in dentofacial orthopedics are now well known, but it is still essential that practitioners who have recourse to these treatment methods should be able to practice them.

The Neuro-Psychiatric Approach to Dento-Facial Orthopedics

By J. Cauhépé, B. Schmitz, and J. M. Bouvet. Rev. stomatol. **60**: *481-490, 1959.*

In dentofacial orthopedics, as in other branches of medicine, the need for data provided by a complete clinical examination in order that treatment may be planned along etiological lines makes necessary a team approach to the handling of patients.

While the morphologic diagnosis of dentofacial abnormalities has become more accurate, the etiological diagnosis has at the same time been enriched with new knowledge concerning neuromotor physiology. This, when applied to the growth of the face, makes possible an explanation of the pathogenesis of abnormalities localized in the alveolar processes.

In 1954 Cauhépé gave a precise definition of the techniques for psychomotor education in the functions of the muscles of the mouth. By the following year, kinesiotherapists were able to take their place on medical teams and to treat some children, after a qualitative and quantitative prescription had been given, under the supervision and responsibility of the physician.

For specialists in dentofacial orthopedics, this made the observation of patients more complex and has obliged them to study the nervous physiology of their patients, since the behavior of the facial muscles faithfully reflects the activity of the nervous system.

Consultation with a child psychologist then became necessary. These special consultations provide the stomatologist with valuable information which will allow him to move forward in the research undertaken in connection with the etiology of abnormalities localized in the alveolar processes. This information should likewise make possible further accuracy in treatment involving the psychomotor education of the facial muscles.

For these reasons, the dentofacial orthopedics department of the Institut de Stomatologie has, since 1957, included a neuropsychiatric specialist on its staff. These researches are being carried out by the teaching staff of the Clinical Stomatology Department of the Faculty of Medicine of Paris.

This new member of the team makes a systematic examination, in accordance with the techniques proper to his specialty, of all children for whom there might be a question of whether or not psychomotor education treatment was indicated.

In order to give a strictly clinical value to these complementary examinations, which were intended to supply interesting material for study, the child psychologist had to draw up a plan for specialized examination. This examination places particular stress on the general motor conduction and the motor conduction of the face, as well as on the child's affectivity.

Dentofacial disorders have a functional origin, and psychosomatic medicine has stressed the importance of the psychoaffective factor in the maintenance, if not in the conditioning, of these disorders. The child's personality and his deep-seated unsatisfied needs most certainly play a part in the persistence of a mode of deglutition and articulation which suggest regressive behavior.

Second, there must be a better appreciation of the indications for treatment in terms of the psychological aspect of the problem.

Neuromotor education is contraindicated in the case of children who are hypotonic, weak, and of low intelligence, for a minimum of intellectual understanding on the part of the patient is required. Certain children seem to lend themselves particularly well to such education.

Generally speaking, the quality of the child–therapist relationship is of the greatest importance for the proper management of the treatment, as is also the

attitude of the family environment toward treatment which may sometimes seem to the child to be quite baffling; parental opposition very quickly noticed by the child can explain some unexpected failures. Deep-seated factors may also come into play; the mother may unconsciously refuse measures intended to influence disorders which are present in herself as well, as though her own personality were being attacked. (One is struck by the number of cases in which the mothers of the children examined move their own tongues forward between the dental arches.)

Dentofacial orthopedics offers psychosomatic medicine a new field in which the observation of children with certain malformations particularly lends itself to interesting studies.

Radiological Hazards to Patients

Editorial. Brit. D. J. **109**: *471-472, Dec. 20, 1960.*

The recommendations for diagnostic radiography are that there shall be adequate purpose for x-ray examination; the technique should limit the area irradiated to that which is necessary; whenever possible, the beam should not be directed toward the gonads; films of the highest speed consistent with satisfactory diagnostic value should be used; and fluoroscopy should be avoided when possible. Equipment should be maintained to the standard laid down in the "Code of Practice for the Protection of Persons Exposed to Ionizing Radiations," and obsolete equipment or apparatus that is inadequately screened against the emission of unwanted rays should not be used.

NEWS AND NOTES

American Association of Orthodontists 1962 Research Meeting

The research meeting of the American Association of Orthodontists will be a program consisting of a series of ten-minute research reports which shall be presented orally or read by title only. All persons engaged in research in orthodontics or cognate fields are invited to participate in this program, which will be held April 29 to May 3, 1962, in Los Angeles, California.

Each participant is asked to prepare a 300 word abstract of his research project for publication in the AMERICAN JOURNAL OF ORTHODONTICS and a 25 word summary of the work to be included in the program for the meeting. Abstracts for publication, summaries for the program, and the ten-minute oral presentations to be given at the meeting should be carefully prepared in order that an adequate description of the import of the work may be presented.

Forms for use in submitting the titles, 300 word abstracts, and 25 word summaries of research projects will be sent to the orthodontic department of each dental school and to any individual requesting one.

In order to be included in the program of the research meeting in Los Angeles, titles, abstracts, and summaries of research projects must be mailed not later than Jan. 1, 1962, to Dr. Richard A. Riedel, Department of Orthodontics, University of Washington, School of Dentistry, Seattle 5, Washington.

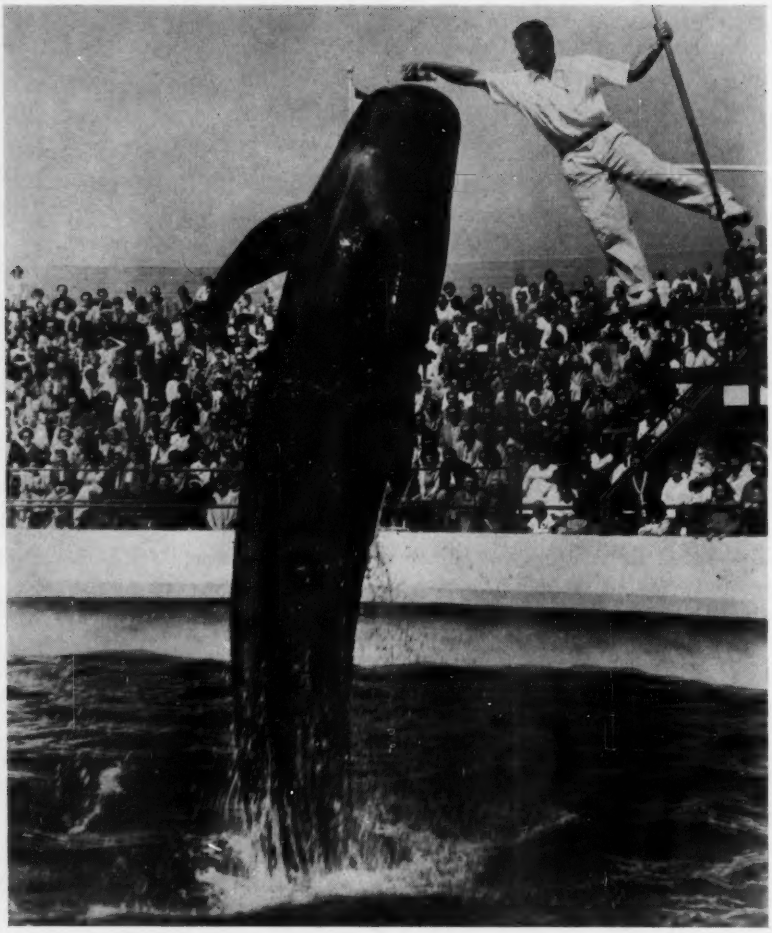
Faustin N. Weber, Chairman, Research Committee
American Association of Orthodontists
Professor and Head, Department of Orthodontics
University of Tennessee
847 Monroe Ave.
Memphis 3, Tennessee.

American Association of Orthodontists 1962 Milo Hellman Prize Essay Contest

ELIGIBILITY. Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry or associated with it as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

CHARACTER OF ESSAY. Each essay submitted must represent an original investigation and contain some new significant material of value to the art and science of orthodontics, and it must be the contestant's first research orthodontic publication.

AWARDS. Two Hellman Awards are offered—one for the best work presented (the experienced as well as the new researcher is eligible for this award) and one for a researcher



Marineland of the Pacific. Bimbo, the biggest whale in captivity, can hurl his 3,400 pound, 18 foot body almost completely out of water. This is but one of the many interesting sights that await those who attend the annual meeting of the American Association of Orthodontists in Los Angeles, California, April 28 to May 3, 1962.

presenting his initial essay. A cash prize of $500.00 is offered for the essay judged to be the best submitted from those papers that represent the contestants' first research essay. However, the Committee reserves the right to omit either or both awards if, in its judgment, none of the essays is considered worthy of an award. Honorable mention will be awarded to the four authors whose essays are ranked immediately below the prize essay. Each of the honorable mention awards carries a $100.00 cash prize. As in the case of the prize essay, the Committee may, at its discretion, omit any or all honorable mention awards if the entries submitted are not worthy of them. The Hellman Award essays and the first two essays meriting honorable mention will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

SPECIFICATIONS. All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced, with at least 1 inch margins. Each sheet must be numbered and bound or assembled with paper fasteners in a "brief cover" for easy handling. The title of the essay should appear on the cover. Five complete copies of each essay, including all illustrations, tables, and bibliography, must be submitted. The name and address of the author must not appear in the essay. For purposes of identification, the title of the essay and the author's

name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.), should be typed on a separate sheet of paper and enclosed in a plain sealed envelope. The title of the essay should appear on the outside of this sealed envelope.

PRESENTATION. The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists in Los Angeles, California, April 29 to May 3, 1962.

JUDGES. The entries will be judged by the Research Committee of the American Association of Orthodontists.

FINAL SUBMISSION DATE. No essay will be considered for this competition unless it is postmarked on or before Jan. 1, 1962, and five copies of the essay sent to Dr. Albert P. Westfall, University of Texas Dental Branch, Department of Orthodontics, Houston 25, Texas.

Faustin N. Weber, Chairman, Research Committee
American Association of Orthodontists
Professor and Head, Department of Orthodontics
University of Tennessee
847 Monroe Ave.
Memphis 3, Tennessee.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Statler Hotel in Los Angeles, California, Monday through Saturday, April 23 to 28, 1962. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Alton W. Moore, University of Washington, School of Dentistry, Seattle 5, Washington.

Applications for acceptance at the Los Angeles meeting, leading to stipulation of examination requirements for the following year, must be filed before March 1, 1962. To be eligible, an applicant must have been an *active* member of the American Association of Orthodontists for at least two years.

Great Lakes Society of Orthodontists

It has become necessary to change the dates of the annual meeting of the Great Lakes Society. The meeting will be held Nov. 26 to Dec. 1, 1961, at the Eden Roc Hotel in Miami Beach, Florida.

The following papers will be presented:

Radiographic Interpretation of Temporomandibular Joint Disturbances. William Updegrave, Philadelphia, Pennsylvania.

Diagnostic Procedures for Disorders of the Temporomandibular Joint. Laszlo Schwartz, New York, New York.

Harmonious and Disharmonious Functions of the Temporomandibular Joint's Musculature and Occlusion. John R. Thompson, Chicago, Illinois.

Techniques for Radiographic Surveys of the Temporomandibular Joint. William Updegrave, Philadelphia, Pennsylvania. (Dr. Updegrave will supplement his paper with a table clinic.)

Methods of Treatment of Disorders of the Temporomandibular Joint. Laszlo Schwartz, New York, New York.

The Interrelations of Facial Pattern, Facial Growth, and Function. John R. Thompson, Chicago, Illinois.

Mandibular Ostectomy and Osteotomy. Robert Ponitz, Ann Arbor, Michigan.

Light Wire and Light Forces. Parts I and II. Charles Burstone, Indianapolis, Indiana. (Dr. Burstone will supplement his paper with a table clinic.)

Treatment in the Mixed Dentition. Charles Tweed, Tucson, Arizona.

Treatment in the Adult Dentition. Charles Tweed, Tucson, Arizona.

Cephalometric Analysis for Comprehensive Diagnosis and Special Treatment. Scott Holmes, Muskegon, Michigan.

Other highlights of the meeting will be the presentation of American Board case reports, a symposium by Drs. Updegrave, Schwartz, and Thompson, table clinics, a review of institutional research from 1954 to 1960 by Ben Williams of Columbus, Ohio, business sessions, and installation of new officers.

Social activities will include special luncheons, a fashion show for the ladies, two night club tours, and the president's reception and banquet.

Uruguayan-Argentinian International Congress of Odontology

Readers of the AMERICAN JOURNAL OF ORTHODONTICS have been invited to attend the Uruguayan-Argentinian International Congress of Odontology in Montevideo, Uruguay, Nov. 12 to 17, 1961. Many orthodontists of international reknown will participate in this meeting.

Help sought in search for missing boy

The JOURNAL has been asked to help in the search for a missing boy. Bruce Crawford, age 15, is 5 feet 9 inches tall and weighs 135 pounds. He has brown hair and brown eyes and wears edgewise bands on his lower teeth. He also uses contact lenses and has a hairline scar over the bridge of his nose. When last seen, he was wearing medium blue trousers, a gray Ban-Lon short-sleeved sweater, black loafers, and a charcoal gray suede zipper-front jacket. He may be carrying a large blue "gym bag."

Any information concerning this boy will be greatly appreciated and should be forwarded to Mr. and Mrs. Robert D. Crawford, 75 Gra-Gull Dr., Avon Lake, Ohio, or to the Avon Lake Police Department.

Courses in orthodontics sponsored by universities

The School of Dentistry of the Loma Linda University has accepted six students in its graduate program in orthodontics for this year. This is a twenty-one-month program leading to a master's degree.

According to an announcement by Kenneth Marshall, director of the Orthodontic Department of the St. Louis University School of Dentistry, a course in the edgewise technique is to be co-sponsored by St. Louis University School of Dentistry and the Charles H. Tweed Foundation. This course will be given in Tucson, Arizona, May 6 to 19, 1962. Co-directors are Drs. Charles Tweed and Levern Merrifield.

Dr. Marshall announces also that a course in the edgewise technique will be presented at the St. Louis University School of Dentistry in St. Louis, Missouri, July 9 to 20, 1962. Co-directors of this course are Drs. Samuel Lewis and Vernon Truetzel.

The fifth annual meeting of the Orthodontic Education and Research Foundation of St. Louis University School of Dentistry will be held Feb. 25 to 27, 1962, at the Chase Hotel in St. Louis, Missouri, according to an announcement by President Vernon Truetzel. Speakers will be Drs. Charles Tweed, Hugh Sims, Edward J. Forrest, and LeRoy Peterson.

Notes of interest

John P. Anderson, D.M.D., M.S.D., announces the removal of his office to 286 S. W. Watson St., Beaverton, Oregon, orthodontics exclusively.

Arthur I. Bell, D.D.S., is pleased to announce the association of James L. Abbott, D.D.S., in the practice of orthodontics at 1009 Frederick Rd., Catonsville, Maryland.

Obed J. Berg, D.D.S., announces that his practice is now limited to orthodontics. Dr. Berg has offices at 308 Grove, Decorah, Iowa, and 17½ N. Fredrick, Oelwein, Iowa.

Alden J. Bush, Jr., D.D.S., takes pleasure in announcing the association of Robert M. Coyne, D.D.S., in the practice of orthodontics at 50 Park Ave., Dayton, Ohio.

Jack G. Dale, B.A., D.D.S., announces the opening of his office at 185 St. Clair Ave., W., Toronto, Ontario, Canda, practice limited to orthodontics.

Irvin Hockstein, D.D.S., M.S., announces the opening of his offices for the exclusive practice of orthodontics at 1401 Pennsylvania Ave., Wilmington, Delaware.

Wilbur D. Johnston, D.D.S., M.D., is pleased to announce the association of Robert Wade Seniff, D.D.S., M.S., in the practice of orthodontics, 215 Whitney Ave., New Haven, Connecticut.

Solomon J. Kessler, D.D.S., takes pleasure in announcing that Jerome M. Zweig, D.D.S., will hereafter be associated with him in the practice of orthodontics at 91 Lyons Ave., Newark, New Jersey.

Lee R. Logan, D.D.S., M.S., announces the removal of his offices to 18250 Roscoe Blvd., Northridge, California, practice limited to orthodontics.

Yoshitaka Ogata, D.D.S., M.S.D., has completed his tour of duty as an orthodontist in the Armed Forces Dental Service and announces the opening of his office for the limited practice of orthodontics at 1021 Fourth & Pike Bldg., Seattle, Washington.

Herbert P. Ostreicher, D.D.S., announces the opening of his office at 1118 Cedar Dr. North, New Hyde Park, New York, practice limited to orthodontics.

Paul F. Peppard, D.D.S., announces the opening of his office at 27927 Deep Valley Dr., Palos Verdes, California, practice limited to orthodontics.

Kenneth L. Sagrans, B.S., M.Ed., D.M.D., announces the relocation of his office for the practice of orthodontics at 3911 Hollywood Blvd., Hollywood, Florida.

Forthcoming meetings of the American Association of Orthodontists:

1962—Statler Hotel, Los Angeles, California, April 28 to May 3.
1963—Hotel Fontainebleau, Miami Beach, Florida, May 5 to 9.
1964—Palmer House, Chicago, Illinois, May 10 to 14.
1965—Dallas Statler-Hilton, Dallas, Texas, April 25 to 30.

*Officers of Orthodontic Societies**

The *American Journal of* ORTHODONTICS is the official publication of the American Association of Orthodontists and its component societies. The Editorial Board of the JOURNAL is composed of a representative of each of the component societies.

American Association of Orthodontists *Next meeting April 28–May 3, 1962, Los Angeles*

President, Dallas R. McCauley, 410 South Beverly Dr., Beverly Hills, Calif.
President-Elect, J. A. Salzmann, 654 Madison Ave., New York, N. Y.
Vice-President, J. Lyndon Carman, 501 Republic Bldg., Denver, Colo.
Secretary-Treasurer, Earl E. Shepard, 225 South Meramec, Clayton, Mo.

Great Lakes Society of Orthodontists *Next meeting Nov. 26–Dec. 1, 1961, Miami Beach*

President, Paul V. Ponitz, 914 Security Bank Bldg., Battle Creek, Mich.
Secretary, Edward A. Cheney, 2900 Grand River, Lansing, Mich.
Director, Harlow L. Shehan, 601 Jackson City Bank Bldg., Jackson, Mich.

Middle Atlantic Society of Orthodontists *Next meeting Nov. 26-29, 1962, Atlantic City*

President, William A. Giblin, 85 Park St., Montclair, N. J.
Secretary-Treasurer, Paul A. Deems, 835 Park Ave., Baltimore, Md.
Director, Louis E. Yerkes, 825 Linden Ave., Allentown, Pa.

Midwestern Society of Orthodontists *Next meeting Sept. 16-18, 1962, Omaha*

President, Elmer S. Bay, 216 Medical Arts Bldg., Omaha, Neb.
Secretary-Treasurer, Kenneth E. Holland, 1016 Sharp Bldg., Lincoln, Neb.
Director, G. Hewett Williams, 811 Elm St., Winnetka, Ill.

Northeastern Society of Orthodontists

President, Irving Grenadier, 888 Grand Concourse, New York, N. Y.
Secretary-Treasurer, David Mossberg, 36 Central Park S., New York, N. Y.
Director, Norman J. Hillyer, 230 Hilton Ave., Hempstead, L. I., N. Y.

Pacific Coast Society of Orthodontists *Next meeting February, 1964, Las Vegas*

President, Herbert V. Muchnic, 435 N. Roxbury Dr., Beverly Hills, Calif.
Secretary-Treasurer, Warren A. Kitchen, 2037 Irving St., San Francisco, Calif.
Director, William S. Smith, 2530 Bissell Ave., Richmond, Calif.

Rocky Mountain Society of Orthodontists

President, Louis J. Williams, 9th & Center Sts., Casper, Wyo.
Secretary-Treasurer, Hubert J. Bell, Jr., 230 Mercantile Bank Bldg., Boulder, Colo.
Director, Louis J. Williams, 9th & Center Sts., Casper, Wyo.

Southern Society of Orthodontists

President, Charles E. Harrison, 362 Sixth St., S., St. Petersburg, Fla.
Secretary-Treasurer, William H. Oliver, 1915 Broadway, Nashville, Tenn.
Director, Boyd W. Tarpley, 2118 Fourteenth Ave., S., Birmingham, Ala.

Southwestern Society of Orthodontists

President, Bibb Ballard, 7713 Inwood Rd., Dallas, Texas
Secretary-Treasurer, Tom M. Matthews, 8215 Westchester Dr., Dallas, Texas
Director, Nathan Gaston, 701 Walnut St., Monroe, La.

American Board of Orthodontics *Next meeting April 23-28, 1962, Los Angeles*

President, J. A. Salzmann, 654 Madison Ave., New York, N. Y.
Vice-President, B. F. Dewel, 708 Church St., Evanston, Ill.
Secretary, Alton W. Moore, University of Washington School of Dentistry, Seattle, Wash.
Treasurer, Paul V. Reid, 1501 Medical Arts Bldg., Philadelphia, Pa.
Director, Frank P. Bowyer, 608 Medical Arts Bldg., Knoxville, Tenn.
Director, Nathan G. Gaston, 701 Walnut St., Monroe, La.
Director, Richard M. Railsback, 1333 Grand Ave., Piedmont, Calif.

*In order to keep this list up to date, the editor depends on the various sectional editors to notify him immediately of changes in officer personnel.

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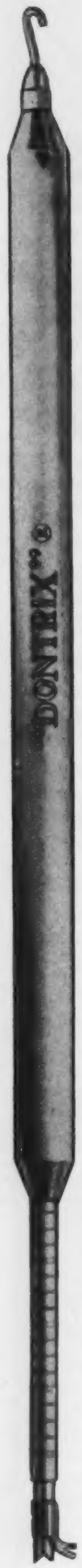

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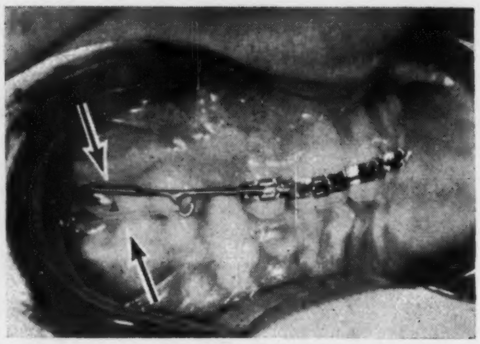

Fig. 141. Combination of compressed coil-spring and intermaxillary elastic traction used in posterior molar movement.

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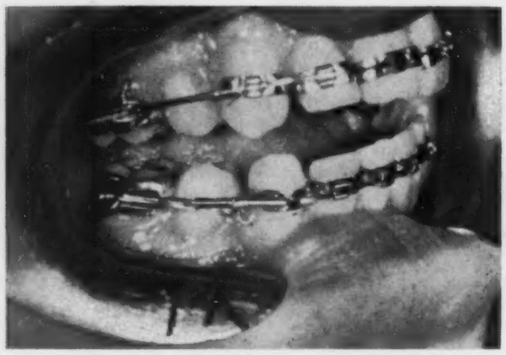

Fig. 131. A, Space closer used on end section of mandibular twin-wire labial arch.

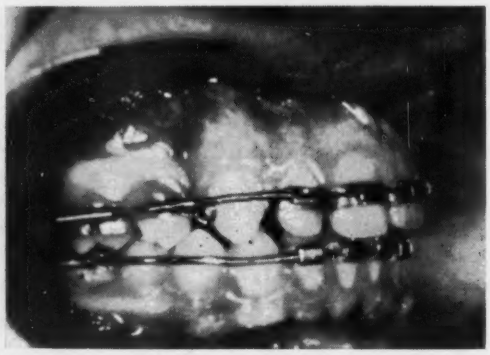

Fig. 131. B, Space closer used on end section of maxillary twin-wire labial arch.

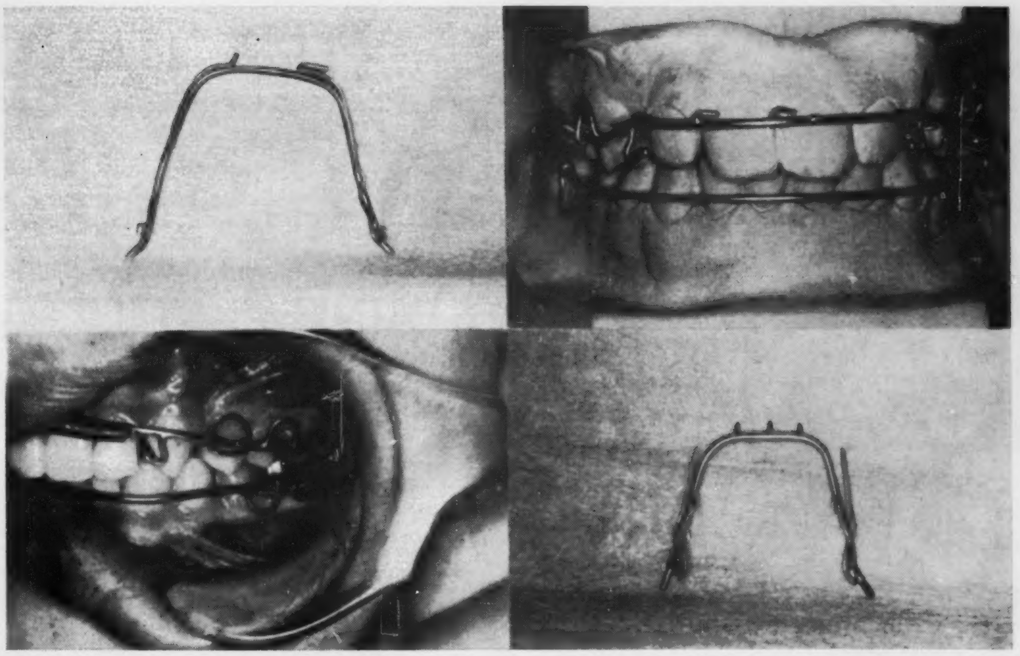

Fig. 182—Top, Left: Left, horizontal posterior curved auxiliary spring. Right, horizontal posterior recurved auxiliary spring. *Fig. 183*—Top, Right: Labial appliance with perpendicular curved auxiliary springs and intermaxillary rubber band hooks of .035 wire. *Fig. 184*—Bottom, Left: Left to right, labial arch with horizontal right angle auxiliary spring, intermaxillary hook, perpendicular loop auxiliary spring, mandibular rubber band hook and labial arch tied in at buccal tube. *Fig. 185*—Bottom, Right: Left and right, horizontal posterior recurved auxiliary spring. Center, perpendicular straight auxiliary spring.

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By BOYD W. TARPLEY, B.A., D.D.S., Professor and Chairman, Department of Orthodontics, University of Alabama School of Dentistry, Birmingham, Ala. Price, $10.50.

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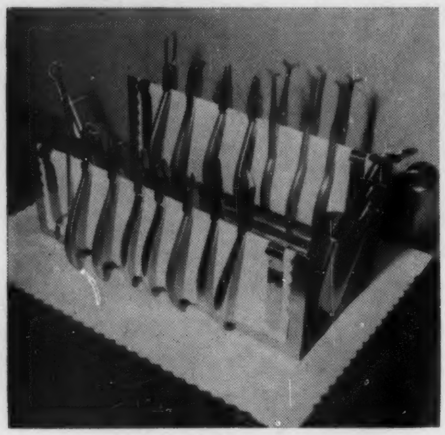

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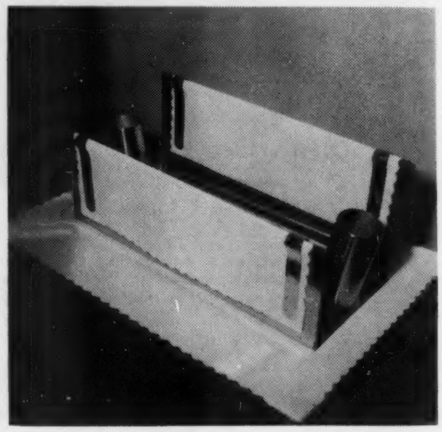

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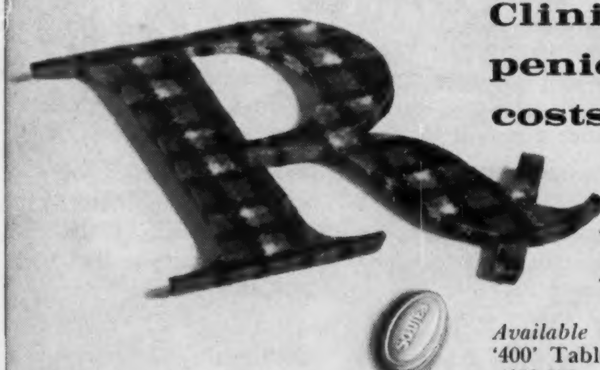

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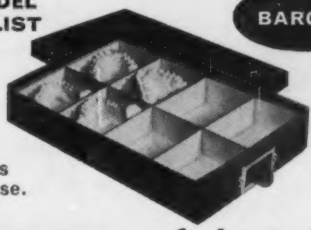

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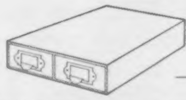

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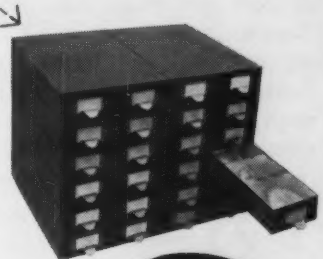

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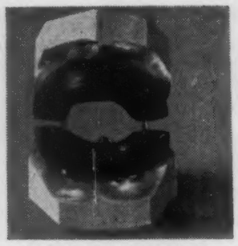
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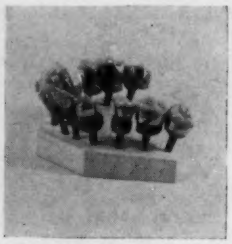
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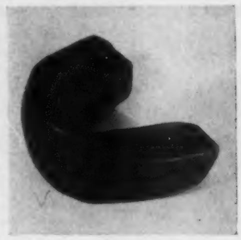
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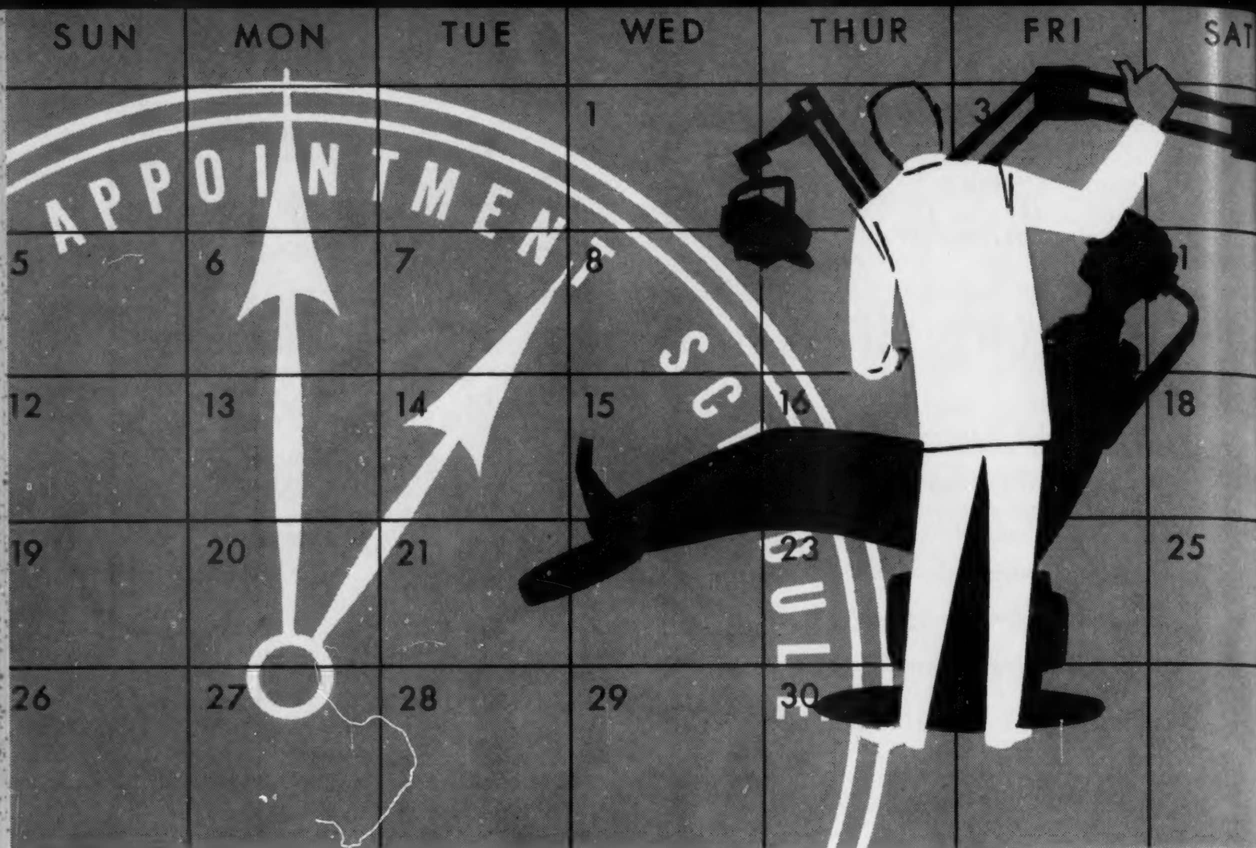

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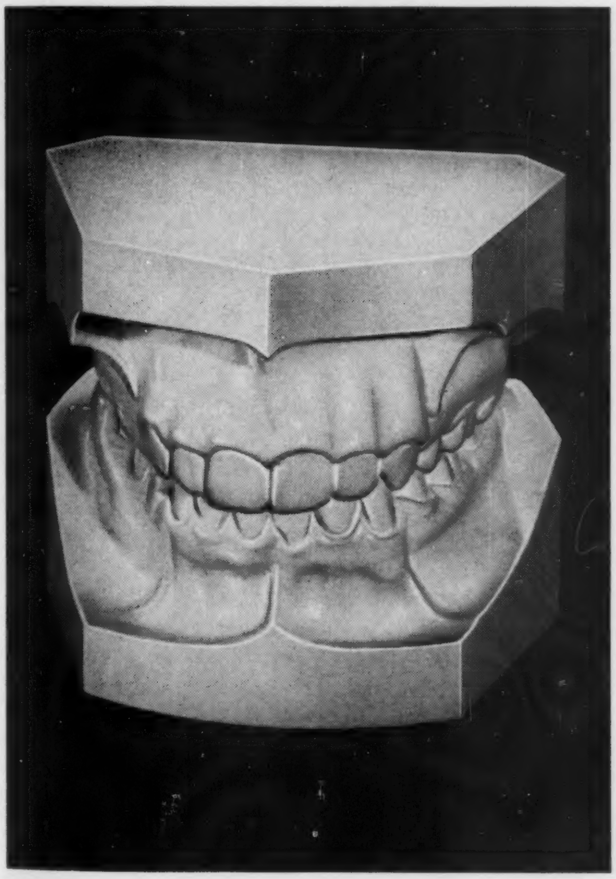

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